© THE QUEEN'S PRINTER FOR
ONTARIO
2000

REPRODUCED WITH PERMISSION

L'IMPRIMEUR DE LA REINE POUR
L'ONTARIO

REPRODUIT AVEC PERMISSION

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel: (416) 362-5211
Toll free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

Significant Wildlife Habitat
Technical Guide

Ontario Ministry of Natural Resources
October 2000

Ontario

101-04166/

Significant Wildlife Habitat
Technical Guide

2000

Fish and Wildlife Branch
Wildlife Section

Science Development and Transfer Branch
Southcentral Sciences Section

© 2000, Queen's printer for Ontario

Printed in Ontario, Canada

MNR #51438
(.5k P.R. 00 10 16)
ISBN# 0-7794-0195-6 (printed edition)

This publication should be cited as:
OMNR. 2000. Significant wildlife habitat technical guide. 151p.

Copies of this publication are available from:

Ontario Ministry of Natural Resources
Fish and Wildlife Branch - Wildlife Section
300 Water Street
P.O. Box 7000
Peterborough,
K9J 8M5

Cette publication scientifique n'est disponible qu'en anglais.

Acknowledgements

This document has undergone numerous reviews. We would like to thank all those who reviewed this document and contributed comments.

Main contributors to the technical guide include:

Kerry Coleman – Ontario Ministry of Natural Resources
Al Sandilands – Biological Consultant
Tim Haxton – Ontario Ministry of Natural Resources
Dave Bland – Biological Consultant
Vivian Brownell – Biological Consultant
Richard Rowe – Ontario Ministry of Natural Resources

Main contributors to the appendices include:

Ruth Grant – Biological Consultant
Don Cuddy – Ontario Ministry of Natural Resources
Mike Oldham – Natural Heritage Information Centre

Table of Contents

Acknowledgements i

List of Tables vi

List of Figures vii

List of Appendices viii

1 Introduction 1

2 A Landscape Approach to Conserving Significant Wildlife Habitat 3
- 2.1 Gap analysis – A critical tool in landscape analysis 6

3 Preparing to Identify Significant Wildlife Habitat 8
- 3.1 Significant wildlife habitat 8
- 3.2 Available information 8
- 3.3 Other information 12
- 3.4 The conservation advisory committee 13
- 3.5 Finding potentially significant wildlife habitat 14
  - 3.5.1 Wetlands 16
  - 3.5.2 Woodlands 17
- 3.6 Mapping significant wildlife habitat 19

4 Identifying Habitats of Seasonal Concentrations of Animals 20
- 4.1 Definition 20
- 4.2 Ecological functions/effects of loss 20
- 4.3 Identification of potentially significant seasonal concentration areas 20
  - 4.3.1 Mapping and verifying known seasonal concentration areas 20
  - 4.3.2 Finding animal Concentration areas that have not been previously identified 21
- 4.4 How to find some specific seasonal concentration areas 22
  - 4.4.1 Winter deer yards 22
  - 4.4.2 Moose late winter habitat 23
  - 4.4.3 Colonial bird nesting sites 23
  - 4.4.4 Waterfowl stopover and staging areas 25
  - 4.4.5 Waterfowl nesting 25
  - 4.4.6 Shorebird migratory stopover areas 26
  - 4.4.7 Landbird migratory stopover areas 27
  - 4.4.8 Raptor winter feeding and roosting areas 27
  - 4.4.9 Wild turkey winter range 28
  - 4.4.10 Turkey vulture summer roosting areas 29

L5

4.4.11 Reptile hibernacula 29
4.4.12 Bat hibernacula 30
4.4.13 Bullfrog concentration areas 31
4.4.14 Migratory butterfly stopover areas 32

5 Identifying Rare Vegetation Communities or Specialised Habitats for Wildlife 33
5.1 Definitions 33
5.2 Ecological function/effects of loss 33
5.2.1 Rare vegetation communities 33
5.2.2 Specialised habitats for wildlife 33
5.3 Identification of potentially rare vegetation communities or specialised habitat for wildlife 34
5.3.1 Potentially rare vegetation communities 35
5.3.2 Specialised habitats for wildlife 36
5.4 How to find some rare vegetation communities or specialised habitats for wildlife 37
5.4.1 Rare vegetation communities 37
5.4.1.1 Alvars 37
5.4.1.2 Tall-grass prairies 38
5.4.1.3 Savannahs 39
5.4.1.4 Rare forest types 40
5.4.1.5 Talus slopes 41
5.4.1.6 Rock barrens 41
5.4.1.7 Sand barrens 42
5.4.1.8 Great Lakes dunes 42
5.4.2 How to find specialised habitats for wildlife 43
5.4.2.1 Habitat for area-sensitive species 43
5.4.2.2 Forests providing a high diversity of habitats 45
5.4.2.3 Old-growth or mature forest stands 45
5.4.2.4 Foraging areas with abundant mast 46
5.4.2.5 Amphibian woodland breeding ponds 47
5.4.2.6 Turtle nesting habitat 47
5.4.2.7 Specialised raptor nesting habitat 48
5.4.2.8 Moose calving areas 49
5.4.2.9 Moose aquatic feeding areas 50
5.4.2.10 Mineral licks 50
5.4.2.11 Mink, otter, marten, and fisher denning sites 50
5.4.3 Highly diverse areas 51
5.4.4 Cliffs 52
5.4.5 Seeps and springs 53

6 Identifying Habitats of Species of Conservation Concern 54
6.1 Definition 54

6.2 Ecological function/effects of loss 54
6.3 Identification of habitat of species of conservation concern 54
6.3.1 A suggested approach to habitat identification 55
6.3.2 Summary 56

7 Identifying Animal Movement Corridors 58
7.1 Definition 58
7.2 Ecological function/effects of loss 58
7.3 Identification of animal movement corridors 59
7.3.1 Recommendations 60

8 Evaluation of Significant Wildlife Habitat 62
8.1 Evaluation criteria and guidelines 62
8.2 Field investigations 65
8.3 Evaluation of habitat of seasonal concentrations of animals 66
8.3.1 Winter deer yards 67
8.3.2 Moose late winter habitat 67
8.3.3 Colonial bird nesting sites 68
8.3.4 Waterfowl stopover and staging areas 69
8.3.5 Waterfowl nesting habitat 69
8.3.6 Shorebird migratory stopover sites 70
8.3.7 Landbird migratory stopover areas 71
8.3.8 Raptor wintering areas 72
8.3.9 Wild turkey wintering areas 72
8.3.10 Turkey vulture summer roosting areas 73
8.3.11 Reptile hibernacula 73
8.3.12 Bat hibernacula 73
8.3.13 Bullfrog concentration areas 74
8.3.14 Migratory butterfly stopover areas 74
8.4 Evaluation of rare vegetation communities 75
8.5 Evaluation of specialised habitats for wildlife 76
8.5.1 Sites supporting area-sensitive species 77
8.5.2 Forest stands providing a diversity of habitats 78
8.5.3 Old growth or mature forest stands 78
8.5.4 Seeps and springs 79
8.5.5 Woodlands supporting amphibian breeding ponds 79
8.5.6 Special woodland feeding habitat 80
8.5.7 Osprey nesting habitat 80
8.5.8 Turtle nesting habitat 80
8.5.9 Special moose habitats–aquatic feeding areas, calving sites and mineral licks 81
8.5.10 Mink and otter feeding/denning sites; marten and fisher denning sites 81
8.5.11 Areas of high diversity 82

8.5.12 Cliffs and caves 82
8.6 Evaluation of habitat of species of conservation concern 82
8.7 Evaluation of animal movement corridors 83

9 Ranking Significant Wildlife Habitat 85
9.1 An evaluation of three ranking methods 85
9.2 Recommended method for ranking similar habitats 88
9.2.1 Importance of representation of habitats 88
9.2.2 Establishing minimum standards for representation 88
9.2.3 Minimum standards of other selected evaluation criteria 89
9.2.4 Avoiding numerical values for some minimum standards 90
9.2.5 Explanation of the tables in Appendix Q 90

10 How Much Habitat to Protect 92
10.1 Difficulties in determining how much habitat to protect 92
10.2 Some considerations for determining how much habitat to protect 93
10.3 What to protect?- summary of guidelines 96
10.4 How much to protect?- summary of factors to consider 99
10.5 How much to protect?- suggested Amounts 100
10.6 Some hypothetical examples 105
10.7 General habitat requirements of species of conservation concern 120
10.7.1 Seasonal concentration areas 120
10.7.2 Rare or specialised habitats 122
10.7.3 Habitat of species of conservation concern 124

11 Assessment of the Natural Heritage System 127
11.1 Gap analysis 128
11.1.1 Gap analysis of vegetation communities 129
11.1.2 Gap analysis of species 130
11.2 Restoration and rehabilitation opportunities 131

12 References 134
12.1 Literature Cited 134
12.2 Glossary 137

List of Tables

Table 3-1. Information sources that will assist in the identification of significant wildlife habitat. 9

Table 8-1. General evaluation criteria for wildlife habitats. 63

Table 9-1. Minimum standards evaluation method example. 85

Table 9-2. Additive weighting evaluation method example. 86

Table 9-3. Ranking evaluation method example. 87

Table 10-1. Suggested values for protection of selected wildlife habitats. 101

Table 10-2. Minimum standards for nesting waterfowl for six hypothetical sites. 109

Table 10-3. Minimum standards for three hypothetical off-shield amphibian breeding ponds. 115

Table 10-4. Minimum standards of three hypothetical woodlots for southern flying squirrels. 119

Table 10-5. Primary locations of seasonal concentrations of wildlife. 120

Table 10-6. Primary locations of rare or specialised habitats. 122

Table 10-7. General habitat requirements of selected species of conservation concern. 124

List of Figures

Figure 2-1. Hill's site Regions in Ontario. 4

Figure 4-1. Colonial nesting species such as gulls, will seek islands to nest and return to the same location annually....................24

Figure 5-1. Bogbean buckmoth, specific to eastern Ontario fen habitat, are known in only in two locations in Ontario....................34

Figure 5-2. Monarch caterpillars feed strictly on milkweed. 86

Figure 5-3. Alvar, Misery Bay, Manitoulin Island. 38

List of Appendices

Appendix A.	A description of Ramsar sites, biosphere reserves, Carolinian Canada sites and Western Hemisphere Shorebird Reserve Network and their application in landuse planning.
Appendix B.	Ecological considerations underlying Natural Heritage System planning.
Appendix C.	A list of area sensitive species and key references.
Appendix D.	Guidelines for conducting field investigations.
Appendix E.	Natural heritage gap analysis methodologies used by the Ontario Ministry of Natural Resources.
Appendix F.	List of agencies and organisations and information that may be obtained.
Appendix G.	Wildlife habitat matrices and habitat descriptions for rare vascular plants.
Appendix H.	Suggested terms of reference for the formation and operation of a Conservation Advisory Committee (CAC).
Appendix I.	Information sources for the identification of specific significant wildlife habitats.
Appendix J.	Natural heritage resources of Ontario: Vegetation communities of Southern Ontario.
Appendix K.	Significant waterfowl habitat.
Appendix L.	Practical approaches for identifying rare vegetation communities using the southern Ontario Ecological Land classification approach.
Appendix M.	Locations of known rare vegetation communities in Ontario.
Appendix N	List of indicator species of Alvar, Tall Grass Prairie, Savannah and Carolinian forest habitats in southern Ontario.
Appendix O.	Finding and identifying raptor nests.
Appendix P.	List of endangered, threatened and vulnerable plant and animal species in Ontario.
Appendix Q.	Evaluation criteria for significant wildlife habitat.
Appendix R.	Summary of Forest Management guidelines for various wildlife species.

1 Introduction

In May 1996, the *Provincial Policy Statement* (PPS) was issued under the Planning Act. This document identified matters of provincial interest to be considered as part of the land use planning process in the province of Ontario. Section 3 of the Planning Act requires that planning authorities shall "have regard to" the PPS when exercising any authority that affects municipal planning matters.

Among other things, Section 2.3 of the PPS requires that "natural heritage features and areas will be protected from incompatible development" and that development and site alteration will be permitted on or adjacent to these areas "if it can be demonstrated that there will be no negative impact on the natural features or ecological functions for which the area is identified."

Significant Wildlife Habitat has been identified as a natural heritage area for the purposes of Section 2.3 of the PPS. ***Wildlife*** is described as:

> *"all wild mammals, birds, reptiles, amphibians, fishes, invertebrates, plants, fungi, algae, bacteria and other wild organisms"* (Ontario Wildlife Working Group 1991)

The PPS specifically identifies ***wildlife habitat*** as:

> *areas where plants, animals, and other organisms live, and find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle; and areas which are important to migratory or non-migratory species.*

Wildlife habitat is considered *significant* where it is:

> *ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System. Criteria for determining significance may be recommended by the Province, but municipal approaches that achieve the same objective may also be used.*

The *Natural Heritage Reference Manual–June 1999* (OMNR 1999) and this document the *Significant Wildlife Habitat Technical Guide* were prepared by the Ministry of Natural Resources to assist planning authorities and other participants in the land use planning system. Both documents represent the most up to date information available at the date of publication on specific technical issues.

The *Natural Heritage Reference Manual* is a general reference manual that applies additional information on technical issues relative to Section 2.3 of the PPS. The manual is intended for use by those who have a basic understanding of the Planning Act process and the intent of the PPS. It will be of most interest to those involved in the development and review of policy documents and the review and approval of development applications.

The *Significant Wildlife Habitat Technical Guide* is a more detailed technical manual that provides information on the identification, description, and prioritisation of significant wildlife habitat. This manual is intended for use by ecologists, biologists, environmental planners, and others involved in the development of strategies to identify and protect significant wildlife habitat in the municipal planning process. More specifically it:

- describes in more detail some of the techniques, issues, and processes identified in the *Natural Heritage Reference Manual*
- provides recommended approaches to describe, identify and prioritise significant wildlife habitat
- provides a compilation of relevant technical support materials and references

Neither of these documents should be read in isolation of the PPS. They are advisory only and may be updated as technology or techniques improve. They provide information to assist in understanding the policy. They do not add to or detract from policy. Except as otherwise specified (e.g. where requirements are established by legislation or regulation), they do not represent the only acceptable approaches. There may be other ways to achieve the results established in the PPS. However, in all cases planning authorities must have regard to the PPS.

This technical guide is intended for use in the municipal policy and development process under the Planning Act. However, this document may also be useful in considering applications that must fulfil other approval processes (e.g. Class Environmental Assessments). In cases where matters are subject to other legislation (e.g. Endangered Species Act), appropriate references are noted in the text.

The *Significant Wildlife Habitat Technical Guide* consists of three sections:

Background and approach to significant wildlife habitat (Chapters 1–2)
Identifying significant wildlife habitat (Chapters 3–7)
Evaluating and ranking significant wildlife habitat (Chapters 8–11)

Technical information has been included in the appendices to this document. The appendices are voluminous and presented in a separate document. The intent is to make updates of these appendices permissible as new science and information becomes available.

2 A Landscape Approach to Conserving Significant Wildlife Habitat

The *Natural Heritage Reference Manual* (OMNR 1999) outlines a Natural Heritage System approach. This approach is a useful method for the protection of specific natural heritage features and areas because it reinforces an understanding that individual areas and features have strong ecological ties to other physical features and areas in the overall landscape. When addressing the significant wildlife habitat feature of this system, it is important to consider significant wildlife habitat at more than one scale. Some habitats may be of national or provincial importance, such as an important migration stopover site for migrating birds (e.g. RAMSAR sites–Appendix A). Other habitats may be locally significant, such as a winter concentration area for a local population of deer. Generally, those habitats that are significant at larger scales are considered to be of greater significance than those at the local scale. That does not imply that significance at the local level is not important, as it can be very important. However, scale is a very important criterion when ranking significance between two or more potential sites.

Landscapes are relatively large geographic areas. From an ecological perspective, landscape boundaries are most appropriately defined based on climatic considerations and physiography. These are the two main ecological features used to identify ecological units known as site regions. At a finer scale, vegetation responses to climate and physiography are the primary factors used to define site districts. Hills (1959) divided the province into 14 site regions and 67 site districts (Figure 2-1). The ecosystems that occur in a given site district are distinct from those in other site districts with respect to climate, landform, and patterns of vegetation. For more information on site regions and site districts of Ontario (Figure 2-1), refer to a *Framework for the Conservation of Ontario's Biological Heritage* (Beechey 1980). The Ontario Ministry of Natural Resources (OMNR) has used these ecological units as the basis for determining representation of potential Areas of Natural and Scientific Interest (ANSIs), wetland rarity in the provincial wetland evaluation system, and for determining the rarity of species and vegetation communities across the province. Planning authorities can also use these units as a basis for making landscape level decisions with respect to significance. Other criteria can be used to define landscape boundaries, such as watersheds, sub-watersheds, regional municipalities, and counties. Landscapes that only consider the smaller scales are not as ecologically sound as large-scale landscapes in natural heritage planning. Many significant features extend beyond administrative boundaries and certainly, wildlife is not confined by these boundaries. Planning authorities have to make planning policies for land within their jurisdiction. Ideally, a Natural Heritage System for a planning area would incorporate a variety of scales from global to local and these would be taken into account during the planning process.

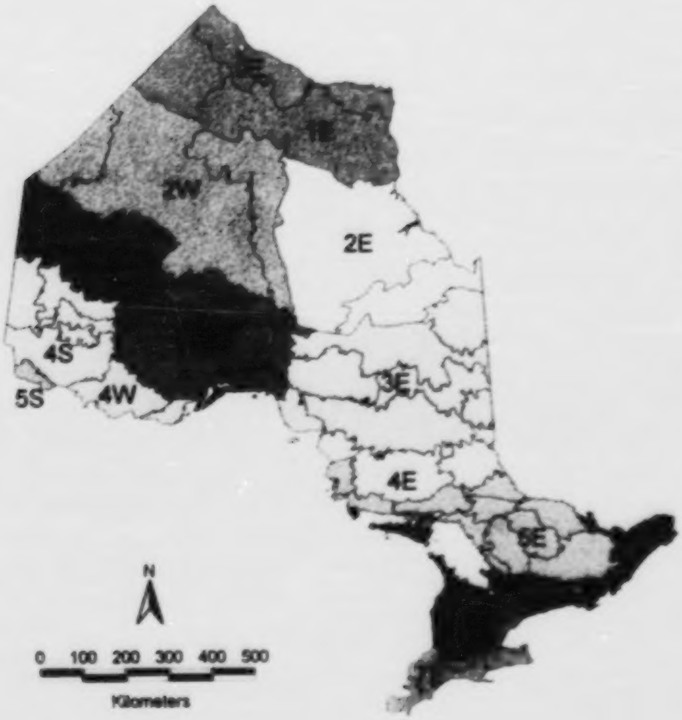


Figure 2-1. Hill's Site Regions (modified) in Ontario.

By definition, a landscape approach to Natural Heritage System planning involves assessing the relative ecological value of individual features in a particular area in relation to other similar features in a larger area (i.e. a landscape). Such an approach, particularly when it considers natural heritage features at a variety of scales results in a comprehensive, sound Natural Heritage System. The concept of assessing ecological importance to similar features in a larger landscape can and should be applied even at the site-specific scale. A particular habitat for a species may be considered as significant wildlife habitat because it is under-represented at some scale in the landscape. This could be at the provincial scale, site region or even at the planning area level. Generally, greater priority is given to representation at larger scales.

The concept of representation at a variety of scales in the landscape can assist planning authorities to determine what habitats should be considered significant. For example, the black tern is a colonial nesting bird species that is under-represented (rare) at the provincial scale. Because these colonies are critical to local populations and the species is rare provincially, it is reasonable to assume that all colonies of this species should be considered significant. The great blue heron is also a colonial nesting bird. It is not under-represented (rare) at the provincial scale. Great blue herons can nest in colonies ranging from 5 or 6 nests to well over 100 nests. In smaller landscapes where great blue herons are common, the planning authority may decide that only those colonies with greater than a specific number of nests (e.g. >25), should be considered significant. However, in other small landscapes where great blue heron populations have declined from historical levels and are not common, the planning authority may decide that all colonies that are found in the planning area should be considered significant.

Natural heritage planning at the landscape scale has a number of advantages. These include:

1. Enabling resource planners to identify the most important natural heritage features based on ecosystem representation and linkages between ecosystems. This is more effectively accomplished when examining the entire landscape and later focusing on the site-specific scale, than starting at the site-specific scale and working up to larger scales.

2. Allowing planning authorities to reduce their time and costs early in the planning process. The identification of large natural areas and linkages by using ecologically sound, landscape level criteria such as representation, size, shape, distribution, connectivity and community and species diversity (Appendix B) often does not require extensive field studies. Many of the criteria can be applied using existing information on potential sites as well as remote technologies such as satellite imagery and air photo interpretation.

3. Allowing subsequent finer scale, site-specific planning for significant wildlife habitat to be more focused. After a system of large, well-connected core natural areas has been identified, subsequent efforts to identify site-specific significant wildlife habitat can be concentrated on those portions of the planning area outside of the preliminary Natural Heritage System that have already been identified using landscape criteria.

4. Providing the best protection for significant wildlife habitats that are difficult to identify and quantify. This would include such habitats as waterfowl breeding habitat, amphibian breeding ponds, snake hibernacula, bat hibernacula, marten and fisher denning habitat, habitats for area-sensitive species and a number of other specialised, highly diverse habitats. These habitats are critical to the survival of many species, but are extremely difficult to locate and, when they are located, the significant portions (i.e. critical habitat) of the habitat are often difficult to quantify. The identification and protection of a system of large, well-connected natural areas with good representation of the ecosystems and natural communities in the planning area will often include many of these features. The large size of these areas can provide better protection than if habitats are individually identified and protected as isolated features on the landscape. Isolated habitats, even with protective buffers, are less effective in protecting the ecological functions of a feature than when that feature is part of a larger natural area.

5. Providing a greater probability that the habitat size thresholds of some species are met. The habitat size threshold for many area-sensitive species is much larger than the actual territory of an individual breeding pair (Villard et al. 1992). For example, the loggerhead shrike uses open scrubland habitat. The home range for a nesting pair is generally considered to be a radius of approximately 400 metres around the nest (approx. 0.5 km^2). However, habitats that appear to be suitable may not be used unless

there is a minimum amount of suitable habitat available within a defined landscape. A general guideline is that 10% of the landscape must be suitable habitat. Therefore within a 100 km^2 landscape, 10 km^2 would have to be suitable shrike habitat before any of the habitat would be used. The same concept applies to many area-sensitive species. Appendix C lists a number of area-sensitive species and key references for these species.

6. Allowing better integration of all of the natural heritage features and areas covered by the policy, than when they are identified and evaluated on their own. Ideally, a planning authority's Natural Heritage System should be comprised of a fully represented system of well-connected natural heritage features and areas broadly distributed across the planning area.

The landscape approach to planning for significant wildlife habitat can be considered a first step in the planning process. It does not eliminate the need for finer scale site-specific identification and evaluation of significant wildlife habitat. Chapters 4 to 7 in this guide provide detailed discussion on the identification of site-specific significant wildlife habitat. Some potentially significant wildlife habitat will be missed when identifying a system of core natural areas at the landscape level. Many of these fine-scale sites can be very important habitats.

Examining significant wildlife habitats at a fine scale after a system of large, well-connected natural areas have been identified at the landscape level, provides the opportunity to gain a better understanding of the ecological functions and species interactions within these areas. This can be very beneficial to a planning authority, particularly during consultation regarding potential development in and adjacent to significant wildlife habitat.

Some field studies may be required to verify existing information or to collect information about potentially significant core natural areas. When conducting field studies it should be kept in mind that additional information may be required at a later date for site-specific evaluation (Appendix D).

2.1 Gap analysis – A critical tool in landscape analysis

Gap analysis is the most commonly accepted landscape-scale methodology for identifying high priority natural areas in need of protection. Gap analysis is an approach to identifying and fulfilling natural heritage targets. It facilitates the identification of natural features that are not represented or are under-represented within natural areas systems and is the basis of the OMNR's program for selecting ANSI's. The areas identified form *core* natural areas around which the rest of the Natural Heritage System can be completed. The key assumptions underlying natural area gap analysis are:

- that enduring features on the landscape (i.e. landforms) are more stable in their distribution than vegetation or other biotic elements (Noss 1995)
- that the ecological diversity of an area is largely a result of interactions between climate and enduring features (Noss 1995); and
- that, by representing all landform-vegetation associations in a protected area system, a significant portion of the biodiversity will be maintained (Crins and Kor 1999)

Collectively, these assumptions recognise that the best way to ensure the survival of the greatest diversity of species is to ensure that the widest possible range of habitat types is protected. OMNR's current gap analysis procedures are described in Crins and Kor (1999) and are summarised in Appendix E. Other important references include NCASI (1996) and Riley and Mohr (1994).

As described above, a gap analysis is a very useful method for determining which natural areas should be considered for protection. A gap analysis can also be used to determine what natural heritage features may be missing from the landscape. These can also include vegetative or biotic communities that were historically found in the planning area, but are no longer present or have been degraded.

3 Preparing to Identify Significant Wildlife Habitat

3.1 Significant wildlife habitat

To ensure a comprehensive approach to identifying and evaluating significant wildlife habitat, wildlife habitat has been divided into four broad categories:

- seasonal concentration areas
- rare vegetation communities or specialised habitats for wildlife
- habitats of species of conservation concern, excluding the habitats of endangered and threatened species
- animal movement corridors

The task of identifying significant wildlife habitat will be facilitated if other natural heritage features listed in the Natural Heritage Policy are mapped first as outlined by the *Natural Heritage Reference Manual* (OMNR 1999) and the appropriate technical manuals. Many known, as well as unknown, wildlife habitats exist in these other reference areas. Significant wildlife habitat that is found in other natural heritage features is very important and should be identified. However, as a priority, surveys should concentrate on areas outside identified features. It will save time and be more efficient to concentrate on areas not included in other natural heritage features and areas. This approach can also enhance natural heritage conservation if the planning authority concentrates its efforts to find and protect significant wildlife habitats outside the boundaries of the other identified natural heritage features and areas.

However, significant wildlife habitat in other natural heritage areas should not be ignored. These areas may receive development pressure, and it is essential that proponents conducting impact assessments understand their functions and identify potential impacts on significant wildlife habitat.

3.2 Available information

There are several sources of information that will help planning authorities identify significant wildlife habitats. Table 3-1 summarises the most useful information and its specific application to identifying wildlife habitat. Most of the listed information can be obtained from local OMNR offices. A list of agencies and their respective areas of expertise has been comprised in Appendix F.

The most recent aerial photographs used with topographical maps and Ontario base maps (OBMs) will enable the planning authority to determine the precise location of previously mapped significant natural heritage features such as provincially significant wetlands and ANSIs, as well as identify some potential habitats. Interpretation of Forest Resource Inventory (FRI) maps, used with aerial photographs, may help locate potentially rare or specialised communities. Most OMNR district offices have land tenure maps showing lots and concessions; crown land, agreement forests, and provincial wildlife areas; private property; and property owned by conservation authorities and other agencies.

OMNR wetland evaluations are located at OMNR offices. Although class 4 to 7 wetlands are not provincially significant, their evaluations should still be examined for information about significant wildlife habitats, including rare or specialised habitat such as bogs and fens; important seasonal concentration areas for white-tailed deer and waterfowl; and colonial bird sites such as heronries and black tern colonies.

Table 3-1. Information sources that will assist in identification of significant wildlife habitat.

Sources	**Information that source can provide**
Aerial photographs (scale may be 1:10,000 or 1:15,840) Available from: MNR Natural Resources Information Centre[1]	• show relative sizes and precise location of woodlands, grasslands, wetlands, other natural areas • indicate presence and location of human activities (e.g. roads, drainage ditches, pits, quarries, agriculture); settlements and other land uses • reveal location of potential corridors and linkages • indicate presence and nature of buffers • help to verify information from older FRI and topographic maps • photo interpretation can identify some species and discern some types of woodlands (e.g. those dominated by large trees); wetland types (e.g. marsh, swamp); rock outcroppings; dunes • essential for field investigations – navigation, identification, mapping communities and other natural heritage features and areas • help to estimate size of communities
Topographic maps (scale 1:50,000) Available from: Canada Map Office, Natural Resources Canada, 130 Bentley Ave. Nepean, ON K2E 6T9 (1-800-465-6277); local bookstores	• indicate approximate location and size of natural areas and features • show relief of land using incremental contours (e.g. cliffs, lowlands, depressions) • indicate location and type of roads • indicate location of railway tracks, pipelines, hydro corridors, telephone lines • useful in field investigations when used in conjunction with aerial photographs • can provide overview of planning area for larger landscape perspective • can help to identify potential corridors and linkages
Ontario Base Maps (OBM) (scale may be 1:10,000 or 1:15,840) Available from MNR Natural Resources Information Centre[1]	• are same scale as aerial photographs and therefore valuable for identifying precise locations of specific features • useful for mapping areas and features (particularly those that can be identified on aerial photographs) • used for mapping wetlands • some have topographic relief • valuable for locating lot and concession lines
Forest Resource Inventory (FRI) Maps (scale may be 1:10,000 or 1:15,840)	• provide information about tree composition, age, height, stocking of forest stands (be sure to take into account the date of FRIs) • can be used to help map existing forest cover

Sources	**Information that source can provide**
Available from: Natural Resources Information Centre[1]	• can be used to locate older forests which are likely to contain high concentrations of cavity trees, snags and downed logs • have potential to locate uncommon forest associations, sensitive species or species of conservation concern such as forest interior birds **Note:** • not all geographic areas have FRI mapping • composition is not recorded unless it makes up at least 10% of the stand
MNR Land Tenure maps (scales vary 1:125,000, 1:150,000) Available from: Natural Resources Information Centre[1]	• indicate private land, Crown Land, Agreement Forests, Provincial Wildlife Areas, Conservation Authority properties, pits and quarries, evaluated wetlands
County Soil Survey Reports and Maps (Southern Ontario) Available from Ontario Ministry of Agriculture and Food and Rural Affairs (OMAFRA – *ibid.* Appendix F) or MNR Geology Maps available from Canadian Geological Surveys or Ontario Geological Surveys	• provide description of local soils, relief, drainage, forest types • can help to locate potentially rare or specialised communities associated with certain soil, soil depths, landforms • used in wetland evaluations
MNR Wetland Evaluations (scale 1:10,000; some with scale of 1:15,840) Available from MNR area offices	• indicate location, size and type of wetland • identify some rare species, species of conservation concern such as bullfrogs and other amphibians and reptiles • describe types of wetland communities by dominant plant species • indicate presence of uncommon wetland communities (e.g. fens, bogs) • indicate presence of seasonal concentrations of wildlife (e.g. heron colonies, black tern colonies, nesting waterfowl) • indicate wetland's importance to waterfowl • indicate presence of fish habitat • include lists of species observed (not all evaluations) • indicate level of disturbance of the wetland • cite other studies, information sources • maps indicate vegetation communities, wetland types and species

Sources	Information that source can provide
Areas of Natural and Scientific Interest (ANSI) Site District and inventory reports Available from MNR area offices	• provide excellent ecological overview of significant biological areas assessed at the landscape scale • explain basis for selection of sites based on vegetation/landscape features • describe size, location and ecological significance of sites • include list of rare – uncommon flora and fauna observed • list rare species, communities, habitats • identify older forests, diverse communities • include lists of other sites of potential biological significance • include maps (scale 1:250,000), list of references
Ecological Land Classification (ELC) Available from the Federation of Ontario Naturalists, 355 Lesmill Road, Don Mills ON M3B 2W8	• provides lists of natural vegetation communities by site type • can assist with the identification of rare vegetation communities **NOTE:** • forest and wetland classifications completed for northern Ontario and are available from MNR offices in Thunder Bay and Timmins • forest classification completed for central Ontario and is available through the MNR office in North Bay • preliminary classification available for southern Ontario is available in **Bakowsky, W. D.** 1996. *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario.* Ontario Ministry of Natural Resources, Natural Heritage Information Centre, Peterborough Ontario (Appendix J)
Wildlife habitat matrices(*ibid.* Appendix G)	• provides comprehensive list of wildlife species, their provincial range and specific habitat description • can help identify and evaluate habitats for species of conservation concern but can be applied to species found in other habitats as well
Other	• Ontario Geological Survey Peat and Peatland Evaluations provide maps and detailed descriptions of all observed wetland communities (Ministry of Northern Development and Mines) • naturalist reports often include results of inventories conducted on specific areas; some studies have been reported in journals such as the *Canadian Field Naturalist* • Canada Land Inventory provides maps of land capability for agriculture, forestry, recreation, and wildlife (ungulates and waterfowl) (*ibid.* Appendix A) • Conservation Authority Watershed Plans describe natural resource features on a watershed level (local conservation authorities) • Natural Areas Inventory conducted by municipalities • Landsat, Natural Heritage Information Centre, consultant reports, local experts, Parks Canada, Ontario Parks

[1] Ministry of Natural Resources, Natural Resources Information Centre, 1st Floor N, 300 Water St, PO Box 7000, Peterborough ON K9J 8M5 or Rm M1-70 Macdonald Block, 900 Bay St, Toronto ON M7A 2C1

ANSI site district and inventory reports provide excellent summaries of ecologically significant sites. They identify sites that support rare species, species of conservation concern, and areas with high species and community diversity. Frequently a list of other potentially significant sites (in addition to those identified as ANSIs) is listed at the back of the document. They also identify the best known remaining examples of the full range of landform-vegetation associations. These reports were created with the objective of assuring full representation of the biodiversity and natural landscapes for the site district and province. ANSI Site District and inventory reports provide readers with a general understanding of the full spectrum of biological communities that have been identified in the district and why they are important. Of particular interest are candidate ANSIs and ANSIs considered provincially or regionally significant.

Descriptions of the habitats of species of conservation concern are listed in the habitat matricesfound in Appendix G. This list can help the planning authority identify species that are likely to occur in its jurisdiction and to identify potentially significant habitats for them. The planning authority may wish to compile/establish its own list of species of conservation concern, based on more specific knowledge of wildlife and wildlife habitat within its jurisdiction and on criteria that better meet the planning authority's needs.

3.3 Other information

Interest in conservation biology has grown rapidly during the past 10 years. A result of this has been an increase in the number of publications about developing Natural Heritage Systems, and how to protect regional biodiversity and important natural areas. The following reports provide information about how to protect biodiversity, and identify and evaluate natural areas and features, including wildlife habitat.

The natural heritage of southern Ontario's settled landscapes (Riley and Mohr 1994)

- focus is on the southern Ontario landscape
- provides a good summary of the ecological concepts of conservation biology and reviews some of the most cited conservation biology literature
- discusses core natural areas, corridors, woodland ecosystems etc.
- discusses the formation of Natural Heritage Systems.

Saving nature's legacy (Noss and Cooperrider 1994)

- one of the best and most comprehensive books about protecting and restoring native biodiversity
- provides numerous case studies of application of concepts of conservation biology
- many suggestions and recommendations for evaluation of natural areas, and building a Natural Heritage System

Natural Heritage Reference Manual (OMNR 1999)

- provides a summary of some of the most commonly discussed concepts of conservation biology
- based on an extensive review of the literature and written for the layman
- outlines the key concepts of Natural Heritage System planning
- provides recommendations about how to identify and evaluate natural heritage features and areas

Reports produced by consultants and government and non-government agencies can often provide useful information concerning areas with important wildlife habitat. Most of these studies and reports apply to the more densely populated areas of southern Ontario. Some reports have been done for conservation authorities, such as sub-watershed plans, and numerous inventories have been done as part of impact studies for development or utilities right-of-way studies. Contact the ecologist at the local OMNR office to help to locate existing reports and studies that have been conducted in the municipality. Reports may also be found at the offices of Ontario Power Generation, Ontario Hydro Services Company, the Ontario Ministry of Transportation and local municipalities.

3.4 The conservation advisory committee

Local residents and experts can be a tremendous asset to planning authorities. Many of these people have a good knowledge of wildlife, natural heritage features, and ecologically important areas in their municipality. The planning authority can form a Conservation Advisory Committee (CAC) consisting of a voluntary panel of these people, and then involve them in environmental land-use planning. The involvement of such a group in natural heritage planning and decision-making processes can minimise and even eliminate the need for expensive inventories and still provide excellent results. It can assist in establishing lists of significant species and habitats. The use of a CAC may also lend credibility to the planning authority's decisions by involving local residents in the planning decisions and fostering greater acceptance of the need for wildlife habitat protection through education and participation. Please refer to Appendix H for suggestions regarding the formation and operation of a CAC.

One of the most important roles of the CAC is to provide accurate information about specific wildlife habitats within the municipality. These may include animal movement corridors, seasonal concentration areas, rare vegetation communities or specialised habitats, and habitats of species of conservation concern. A CAC may be especially helpful in the development of criteria for determining species of conservation concern and the initial production of these lists for birds, reptiles, amphibians, mammals, vascular plants, and butterflies. Eventually lists for fish and certain other groups of invertebrates might be developed. Finally, if site investigations and habitat assessments are required, the CAC may provide input to the terms of reference for fieldwork. This could potentially save the municipality money by avoiding unnecessary work. In some cases, the CAC, in cooperation with the municipality, may organise field days to collect data on wildlife in specific habitats for which there is little information.

Listed below are some objectives that a CAC might adopt.

- develop criteria for determining local species of conservation concern
- develop criteria for determining the respective quality of wildlife habitats
- determine how much locally significant wildlife habitat should be protected

- determine how to best protect all identified significant wildlife habitat in the municipality
- collect, organise, and file information about flora, fauna, and natural heritage features and areas
- map all identified significant wildlife habitats
- organise and conduct field investigations to gather more site-specific information, update old wildlife habitat information, or find previously unknown habitats and rare species
- develop terms of reference for consultants to collect needed data
- maintain a list of important contacts e.g., experts, government personnel, local landowners and naturalists
- provide input toward decisions regarding conservation priorities for the municipality
- provide guidance for public education programs in the municipality
- assist with the review of development proposals to determine their potential impacts on significant wildlife habitats.

Perhaps the easiest way to find individuals who would like to become involved with such a committee is to speak with local naturalist club and/or fish and game club members. The OMNR may also know knowledgeable people who would be interested in working with the planning authority. Members of the local CAC need not necessarily live in the area, but they must be familiar with the flora and fauna in the municipality.

3.5 Finding potentially significant wildlife habitat

Some wildlife habitat has already been identified and its function is well known. Other potential wildlife habitats and their location may not be known. Some significant wildlife habitats are described in this guide even though very few of these sites have been identified and mapped. Often, this is because they are hard to find (turtle nesting sites, snake, and bat hibernacula). These habitats, however, have been included because they are often critical to the survival of local and even regional populations. When they are located, they should be protected. The information sources discussed in Sections 3.2 and 3.3 and Appendix I provide a starting point for identifying potentially significant wildlife habitats that have not previously been described. They may also be used to determine which sites should be verified because of outdated information. The planning authority should be prepared to maintain an open file for new natural heritage information and revise this information periodically.

Some potential wildlife habitats can be identified by using information such as maps and aerial photographs. Examples of such habitats include animal movement corridors; rare or specialised habitats such as fens, bogs and old growth forests; deer yards; and rare communities such as alvars and savannah and prairie remnants. However, field surveys may be required to confirm their habitat type.

Other wildlife habitats such as bat and reptile hibernacula, habitats of some rare species, and rare vegetation communities; and highly diverse sites are unlikely to be found using these sources alone. However, sometimes potential areas may be identified based on species habitat requirements. This can focus further investigations. In some cases, protection can be provided to sites with the most suitable habitat. For some of these habitats, the planning authority will have to rely more on people such as local experts and OMNR personnel. The CAC may also help to find these hard-to-find habitats.

This guide does not advocate that planning authorities conduct exhaustive searches within their jurisdiction to find "everything." The methods suggested in this guide are intended to focus searches in the most likely sites at the right time of year. By including potentially significant habitats that have not been previously identified and mapped, future work may be conducted on the most likely sites. For example, there may be regular sightings of rare species in the planning area, but the location of critical components of their habitat may be unknown. Until these sites are found and protected either as significant wildlife habitat or part of a larger protected area, the long-term sustainability of these species is not assured.

Significant wildlife habitats do not occupy discrete, isolated parts of the landscape. Often different wildlife habitats, each with different boundaries, are found in the same natural area. Each provides important ecological functions that together give the area high value. For example, a large forest stand may provide forest-interior habitat for breeding birds. It may also provide denning habitat for martens, a woodland breeding pond for amphibians, and enough undisturbed area for wide-ranging carnivores such as fishers and wolves. Identifying the various significant wildlife habitats found at one site may determine the size and shape of the area to be protected. It would also assist in understanding the ecological functions of the site and implications of proposed activities in the area.

Sub-sections 3.5.1 and 3.5.2 describe a general process for finding potentially significant wildlife habitat in wetlands and woodlands. It involves compilation of background information, determination of essential information needed to find specific habitats, steps to take to find the habitat, and suggestions concerning related field work. This process is used in this guide to find previously unidentified wildlife habitat and to verify old information on existing sites.

3.5.1 Wetlands

For all habitats found in wetlands, the first step should be to check the OMNR wetland evaluations and ANSI site district report(s) that cover the municipality, as well as the habitat matrices (Appendix G). Potential significant wildlife habitat might include seasonal concentration areas of colonial birds, waterfowl nesting, or staging areas, or shorebird stopover areas; rare wetland communities such as fens; highly diverse sites; and areas supporting species of conservation concern.

The OMNR wetland evaluations and ANSI site district and inventory reports will document the presence of these habitats if they were observed during the inventory. There are usually more detailed site descriptions for OMNR evaluated wetlands that are also ANSIs. Often several significant wildlife habitats are described for these sites. Information contained in these reports may need to be verified depending on the date of the wetland evaluation or site district report.

The following example describes one way to use the above information to find potentially rare wetland vegetation communities, fens and bogs.

Background information

Bogs are nutrient-poor, acidic wetlands comprised mostly of peat-covered areas with a high water table. The vegetation consists predominantly of a surface carpet of mosses, chiefly *Sphagnum* species, ericaceous shrubs, and sedges. Black spruce is commonly found in many bogs. Tamarack may be present at a lower density and is usually confined to bog edges.

Fens are peatlands characterised by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. Sedge species form the dominant vegetation of fens; mosses may be present or absent. Often there are many small and mid-sized shrubs and sometimes a sparse layer of trees, typically white cedar and tamarack. The water and peat are less acidic than in bogs and often relatively nutrient rich since they receive water through groundwater discharge.

Fens and bogs may be uncommon to very rare wetland communities in many parts of southern Ontario. Numerous fens are found on the Bruce Peninsula.

Information needed

- The OMNR wetland evaluations, note presence of fens and bogs and wetland maps that accompany the evaluations show the precise location of these communities.
- Ontario geological survey peat and peatland evaluation reports also describe and map these communities and are available from OMNR.

- ANSI site district and inventory reports often mention and discuss in some detail many important fens and bogs found in southern Ontario. Other fens may be found listed in the back of the reports.
- ANSI inventory reports note the presence of individual vegetation communities such as fens and bogs. The vegetation community map that accompanies the inventory shows the precise location of these communities and significant features.

How to find

- Ask the OMNR ecologist for locations of fens and bogs in the municipality. Local naturalists and residents may also know where some of these communities are. Many botanists are familiar with these wetlands because of the rare plant species often found in them.
- Locate previously identified fens and bogs by examining all OMNR wetland evaluations, checking the "type of wetland" section for a mark beside fen and bog types.
- Appendix J details a list of rare vegetation communities in southern Ontario.
- For all wetlands with identified fens and bogs, obtain the wetland maps to pinpoint precise location of these communities.
- Ask the OMNR ecologist to determine whether a peat and peatland evaluation was conducted by the Ontario geological survey, and if so, obtain reports and maps from the local OMNR office.
- Check the ANSI site district report(s) that cover the planning area and relevant ANSI inventory reports. Check the descriptions of every wetland, looking for references to fens and bogs. Also, check the list of sites that are not considered provincially or regionally significant ANSIs for mention of fens and bogs.

Field work

Sometimes fens and bogs have not been identified but are known to exist. Local naturalists may volunteer to help the planning authority find these communities. The OMNR ecologist can help confirm whether newly identified wetland communities are truly fens and bogs. Sometimes potential sites can be discovered on aerial photographs.

3.5.2 Woodlands

For significant wildlife habitats in wooded environments, the first step should be to contact the OMNR for advice. Use the FRI maps, ANSI site district report(s), Information sources (Appendix F) and habitat matrices (Appendix G) to develop a list of potentially significant wildlife habitats. Check the *Significant Wildlife Habitat Decision Support System*[1] to determine which significant wildlife habitats may occur in woodlands.

---

[1] Supporting document that is intended to assist in understanding the functions of significant wildlife habitat, potential impacts and possibilities for mitigation.

The following example describes one way to use the above information to find a specialised wildlife habitat: forested areas containing numerous cavity trees.

Information needed

- OMNR FRI maps provide information about size, composition and age of forest stands. Consider the date of the FRI. For example, if the FRI was based on 1978 aerial photography, a mapped forest stand of 60 years of age would be 82 years old in 2000.
- Interpretation of aerial photographs will indicate the largest, most contiguous forest stands of mature trees. For most of southern Ontario, aerial photographs are more recent than FRI maps (1991 vs. 1978) and consequently should be used to verify FRI map information.
- Habitat matrices (Appendix G) provide specific habitat descriptions for species that rely heavily on tree cavities. More detailed information on habitat requirements is provided in the *Significant Wildlife Habitat Decision Support System*.

How to find

- Ask OMNR foresters for locations of mature and overmature forests comprised of species such as basswood, beech, maple, and poplar. They may know of stands with a high concentration of cavities or sites containing concentrations of diseased and/or damaged trees that are likely to have more cavities.
- Examine the FRI maps and note the oldest forest stands and stands with composition consisting primarily of poplar, beech, basswood, and conifers; cavities are commonly found in these tree species.
- Use aerial photographs to locate largest, contiguous forests. Also, note the oldest, most mature forest cover because this can increase the likelihood of finding numerous cavity trees.

Field work

Both known and potentially significant forest stands should be checked for the presence of trees with suitable cavities of a wide range of sizes. In addition, forests with large amounts of fallen logs on the forest floor can have numerous cavity trees. The presence of pileated woodpeckers in a forest indicates cavity trees that may be used by wildlife. Forests containing a large number of trembling aspen, largetooth aspen, and downed logs often attract woodpeckers that can excavate cavities.

Birds such as chickadee and nuthatch use small cavities. Barred owl and porcupine use larger cavities. In general, cavities in living trees are particularly valuable because they usually last longer than those in dead trees. Larger cavities may also be more valuable because they can be used by a greater variety of wildlife.

3.6 Mapping significant wildlife habitat

It is suggested that planning authorities first identify and map the other six component natural heritage features and areas described in Policy 2.3 of the *Provincial Policy Statement* and outlined in the *Natural Heritage Reference Manual* (OMNR 1999). This mapped information is an important component of a natural heritage conservation strategy because it provides a visual overview of the potential Natural Heritage System, and gaps in protection and information.

Mapping existing sites helps to identify unrepresented or under-represented features and habitats within the municipality. Potential links among local natural areas and other important sites, and animal movement corridors in the greater region are easier to see. It also facilitates initial evaluations of potentially significant sites by showing the relative size, location, shape, and degree of fragmentation of existing sites in the planning area.

4 Identifying Habitats of Seasonal Concentrations of Animals

4.1 Definition

At certain times of the year, some species of wildlife are highly concentrated within relatively small areas. In spring and autumn, migratory species of birds and butterflies concentrate in critical stopover areas where they can rest and feed. Other examples of such habitat include winter deer yards, bird breeding colonies, and hibernation sites for bats or snakes. See the *Significant Wildlife Habitat Decision Support System* for a detailed description of significant seasonal concentration habitats.

4.2 Ecological functions/effects of loss

Areas of seasonal concentrations of animals provide important cover and protection from inclement weather conditions and predators. They may also provide access to abundant food sources or nesting and breeding sites. This habitat may be limited and directly influence populations numbers of a species. Loss of these seasonal concentration habitats results in a disproportionate loss of associated wildlife. To maintain the biodiversity of the planning area and Ontario, these critical wildlife habitats should be identified and protected.

4.3 Identification of potentially significant seasonal concentration areas

One approach to the identification of potentially significant seasonal concentration areas is outlined below. Emphasis is on first identifying known important sites and then looking for additional habitats. Appendix C provides sources of information about seasonal concentration of animals. The habitat matrices in Appendix G describe the habitat requirements of species that concentrate seasonally.

4.3.1 Mapping and verifying known seasonal concentration areas

- First, narrow the search for species that may concentrate seasonally. Use the habitat matrices in Appendix G plus the various atlases for the province (butterflies, amphibians and reptiles, breeding birds, mammals [see Appendix I]) to determine which species are likely to occur in the planning area. There is no point in looking for late winter moose habitat or tern breeding colonies if these species are known not to occur in the study area.

- Ask the OMNR ecologist and biologist, and staff at the Canadian Wildlife Service, Ontario Region Office in Ottawa (for birds) to identify known significant seasonal concentrations of animals within the planning area. Appendix C provides information sources for identifying seasonal concentration areas and Appendix G identified habitat requirement for these species. Several provincially and regionally significant seasonal concentration areas have already been recognised and mapped by the OMNR (winter deer yards, some waterfowl stopover areas, and some heronries) and by the Canadian Wildlife Service (some colonial bird nesting sites, some waterfowl breeding and staging habitat, and some shorebird and landbird migratory stopover areas). Sometimes a specific concentration habitat may not be mapped, but knowledgeable staff may be able to identify potential sites (wild turkey and raptor winter roosting areas, amphibian breeding ponds, and migration stopover sites).

- Map (preferably at 1:10,000 scale) all of the important concentration areas that are known to occur in the municipality.

4.3.2 Finding animal Concentration areas that have not been previously identified

- Begin to identify seasonal concentration habitats most likely to exist within the planning area that have not been identified and described. Examples may include potentially significant waterfowl breeding and staging habitats, heronries, and migratory bird stopover areas; winter feeding and roosting areas for hawks, owls, and wild turkeys; turkey vulture summer roosting areas; reptile and bat hibernacula; and butterfly migratory stopover areas. Some of these habitats may not exist in the planning area or the species may not occur even if there appears to be suitable habitat. It must be realised that seasonal concentration areas are difficult to find. For example, snakes often overwinter underground. In spring, a large number of snakes may emerge from a small opening within a few days and unless someone is present at the right time and place, these sites can easily be overlooked.

- Appendix C provides a list of information sources for the identification of seasonal concentrations of animals. OMNR site district and inventory reports, wetland evaluations, sensitive area reports, ANSI inventory reports, and consultant reports are the most easily obtained materials and contain the most site-specific information.

- A Conservation Advisory Committee (CAC) might be very helpful in finding seasonal concentration habitats. They are also an excellent liaison with other groups within the planning area. Landowners with potentially significant wildlife habitats on their property might be able to provide more information. Hunters, anglers, trappers, members of cottage associations, fish and game, and naturalist clubs, as well as people working in the outdoor recreation sector (outfitters and resort operators) are often aware of seasonal wildlife concentrations.

- Encourage knowledgeable people to help the planning authority to identify potentially significant habitats, particularly those habitats that are hard to find.

4.4 How to find some specific seasonal concentration areas

A number of habitats of species that concentrate seasonally are described below and steps to find them are presented. Emphasis is on use of existing information sources to find potentially significant sites. The information sources outlined in Table 3-1 and discussed in Section 3.2 will be very useful to find potentially significant wildlife habitats. Key elements of the habitat are listed. Field investigations may be necessary to confirm the use of the habitat by the species. Specific information about how to conduct field investigations is discussed in Appendix D.

Planning authorities are advised to rely on OMNR advice for locations and significance of deer and moose seasonal concentration areas. However, if they wish to examine these habitats in more detail, a suggested approach is outlined below.

4.4.1 Winter deer yards

White-tailed deer do not move well in deep snow. As snow begins to accumulate, deer start to move to sheltered areas and remain in the general vicinity until early April. In areas with little snow accumulation, such as in much of southwestern Ontario, deer may not yard in the traditional sense, but often still congregate in large numbers in suitable forested areas.

Deer yards consist of a core area of mainly coniferous trees (pines, hemlock, cedar, spruce) with a canopy cover of more than 60%. In severe winters, deer are confined to the core part of the yard. In mild winters, they may be found in loose aggregations in and around the core of the yard. This core area provides primarily shelter, ease of movement, and protection from predators. The land surrounding the core area is usually mixed or deciduous forest. Understorey shrubs and small trees, especially white cedar, provide winter food. When snow accumulation is light, deer move to nearby agricultural land if it provides food such as leftover corn and grains. Deer tend to use the same yards year after year and are not highly adaptable in moving to a new yard. Animals will often move long distances to some deer yards. Generally, deer yards make up about 10% of the summer deer range.

How to find

- OMNR biologists, foresters, conservation officers, and local hunters know the location of some deer yards.
- Use FRI maps in conjunction with aerial photographs to help to find other potential areas. Locate areas consisting of preferred tree species such as hemlock, white cedar,

pines, and white spruce. Use aerial photographs to verify existence of potential sites and to assess the apparent canopy closure and features of the surrounding landscape.

- Conduct field investigations during mid to late winter to confirm use (can be done from a vehicle or aircraft).

4.4.2 Moose late winter habitat

As snow accumulates, moose move to dense stands of coniferous trees that permit easier movement and provide protection from cold winds and predators. This usually occurs in mid to late winter. Canopy closure within the conifer stand should be at least 60% and most trees should be at least 6 metres tall. Moose are not as dependent on late winter habitat in the southern part of their range as they are in the north because snow is generally not as deep and temperatures not as cold as in northern areas. When moose congregate farther south, they generally use the association of hemlock, balsam fir, and white spruce because of its superior snow interception qualities.

How to find

- OMNR biologists, foresters, conservation officers, and some local hunters and trappers may know the location of some late-winter habitat.
- Use FRI maps in conjunction with aerial photographs to help to locate potential habitats. Identify contiguous forest stands consisting of mainly older (> 40 years) conifer trees. FRI maps indicate species composition and age of forest stands.
- Use aerial photographs to verify existence of potential habitats, assess the apparent canopy closure and features of the surrounding landscape, and determine the approximate size of these habitats. Suitable habitat should be greater than 4 ha.
- Conduct field investigation in late winter to confirm use by moose. Since many areas are difficult to reach, flying over potential areas is recommended.

4.4.3 Colonial bird nesting sites

Colonial birds are a diverse group including several species of herons, gulls, terns, and swallows. Sometimes an entire local population can depend on the survival of just one or two colonies. Under favourable conditions, some species are capable of rapid population growth. In some planning areas, species with expanding populations such as ring-billed gulls and double-crested cormorants may be unpopular and considered pests. Planning authorities will have to decide on the level of protection offered to these species. However, these birds are protected by the *Convention of Migratory Birds* and these laws must be abided. The habitat matrices in Appendix G provide a list of all of the colonial nesting birds and describe their habitats.

Generally, herons nest in trees in swamps and along large bodies of water. Gulls and terns prefer to nest on the ground, and colonies are frequently found on islands in the Great Lakes and large rivers such as the St. Lawrence River and Ottawa River. Birds often show considerable nesting site fidelity, returning year after year. Different species of swallows congregate on specific habitat types such as cliffs, banks, and artificial structures. Certain grassland birds are also colonial.

How to find

- Colonial bird nesting sites are often found by speaking with knowledgeable landowners whose property provides suitable habitat. Local naturalists may be especially helpful in finding these sites.
- Check Appendix G to see which of the colonial bird species was documented in the relevant site district(s). Also, check the *Atlas of the Breeding Birds of Ontario* to determine which atlas squares they were sighted in. This will greatly narrow the search. In addition, the habitat information provided in this appendix and the *Significant Wildlife Habitat Decision Support System* will help planning authorities to key in on areas that may support colonial-nesting birds.
- OMNR offices have some information about local heronries but it may be out-dated and require verification. Bird Studies Canada has information on the Ontario Heronry Inventory, which was completed in the early 1990s.
- Check all OMNR Wetland Evaluations because these indicate the presence of colonial nesting species.

Figure 4-1. Colonial nesting species such as gulls, will seek islands to nest and return to the same location annually.

- Bird Studies Canada coordinates the Ontario Birds at Risk program and several colonial-nesting birds are on the list of Ontario Birds at Risk. Volunteers report nesting sites.
- Local conservation authorities may also have wetland or watershed studies that identify these areas.
- Sometimes aerial photographs can help to identify large heronries. They are most easily seen by using a stereoscope or magnifying glass to search lightly wooded swamps consisting of mostly dead trees. Great blue herons tend to use wooded swamps. Aerial photographs can also be used to identify specific habitat types. For example, black terns generally use sedge or cattail marshes that are about 50% water and 50% vegetation. Many of these can be identified on aerial photographs.
- Sometimes black tern and heron colonies can be identified from the air. The flight should cover potential areas identified from aerial photographs and care should be taken not to disturb nesting birds.

- Check potential sites and verify reports of colonies by field investigation.

4.4.4 Waterfowl stopover and staging areas

During spring and fall migration, waterfowl require habitat that supplies adequate food to replenish energy reserves, resting areas, and cover from predators and adverse weather conditions. Migrating waterfowl usually prefer larger wetlands, especially those adjacent to large bodies of water, and relatively undisturbed shorelines with vegetation.

Many waterfowl congregate in relatively large flocks before fall migration. They raise broods in small areas (ponds, marshes, drainage ditches, and creeks). Then they set up a pattern of pre-migration staging, whereby 30 to a few hundred ducks move between feeding ponds and a large night roosting pond. Often these roosting ponds are used until they freeze over and many of them are used year after year. These ponds may be considered locally significant. Appendix K outlines an approach on how to determine significant waterfowl habitat.

How to find

- OMNR staff such as local conservation officers may be aware of important fall staging areas within the planning area, such as areas that traditionally receive heavy hunting pressure. Often local duck hunters and fish and game club members know the most important areas.
- CWS staff know the larger, most significant sites. They also commonly fly to find "baited" ponds and often observe local staging areas.
- Check OMNR wetland evaluations and ANSI inventory reports because these indicate presence of locally and regionally significant waterfowl staging habitat. Conservation authorities may also have wetland or watershed studies that identify locally significant sites.
- Use aerial photographs to find large beaver ponds and small lakes. In early September, observations of flights of ducks in the evening can also help to locate these ponds.
- Conduct field investigation of the most likely areas identified from aerial photographs, preferably in the early evening just before dark.

4.4.5 Waterfowl nesting

The most significant waterfowl nesting sites are usually relatively large, undisturbed upland areas with abundant ponds and wetlands. The upland areas provide nesting cover. Most species nest in grassy or shrubby fields adjacent to wetlands and most nests occur in relatively dense vegetation that is about 50 cm tall. Wood duck, bufflehead, common goldeneye, and hooded merganser nest in cavities in trees located in swamps or on the shorelines of water bodies, and sometimes in adjacent upland woods. Species such as mallard and teal commonly nest near small ponds surrounded by grassy cover. Sites with an aggregation of several small ponds may be significant for waterfowl nesting. Upland areas should be at least 100 m wide so that predators such as racoons, skunk, and fox have difficulty finding nests. The area should also provide plenty of food and cover for young and adult birds.

One of the best approaches for the conservation of waterfowl is to protect relatively large areas with a high density of small and medium-sized ponds. If single wetlands are being examined, large, diverse wetlands are most likely to contain the best nesting habitat for waterfowl (Appendix I).

In 1996, a group of waterfowl experts was assembled to examine criteria for determining significant waterfowl habitat. The group prepared a report that outlined a number of factors that should be considered when identifying significant waterfowl habitat. This report is included as Appendix K.

How to find

- Ask OMNR biologists and local hunters and naturalists for locations of habitats of greatest use. This is often determined by the number of broods on the wetland, although different ponds or wetlands may be used for nesting and brood habitat.
- Check OMNR Wetland Evaluations for indication of significant waterfowl nesting habitat.
- Check with Ducks Unlimited. Staff may know the locations of particularly productive sites.
- Use topographical maps to find areas with a large number of wetlands.
- Use aerial photographs to examine wetlands and determine density, and general nature of surrounding vegetation. Photographs can also help to determine the approximate configuration of the adjacent upland nesting habitat, as well as aggregations of small ponds and potential disturbances to the habitat.

4.4.6 Shorebird migratory stopover areas

Migrating shorebirds often follow shorelines of the Great Lakes in their movements between winter and summer ranges. Traditionally used areas provide safe places to rest and feed to replenish energy reserves needed to continue migration. Large numbers of shorebirds may accumulate in stopover areas during poor flying weather. Important areas must provide relatively undisturbed shorelines that produce abundant food (insects, clams, snails, and worms) for many birds of a variety of species. Great Lakes shorelines provide some of the best shorebird migratory stopover habitat because of their location along migration routes and because wave action maintains large and productive beaches. Southern James Bay is a critical shorebird staging area, particularly in autumn. Almost the entire world population of certain shorebird species may congregate here each year. The shorebird migration period may last one to three months in late summer and fall.

How to find

- Staff at the CWS and OMNR may be aware of the most significant sites. Participants in a recently initiated shorebird monitoring program coordinated by CWS staff may also be aware of locally important sites.
- Ask knowledgeable people such as local birders. These people will probably know the locations of most of the important seasonal concentrations of shorebirds.

4.4.7 Landbird migratory stopover areas

Since flying across large water bodies such as the Great Lakes is potentially exhausting and dangerous for landbirds, many choose to cross at narrow spots (Point Pelee, Wolfe Island). During migration, large numbers of birds move along Great Lakes shorelines and stop at traditionally-used sites to feed, rest, and/or wait out periods of bad flying weather.

These stopover areas must provide a variety of different habitat types ranging from open fields to large woodlands, to provide abundant food and cover for the diversity of different species during migration. In addition, raptors will use updrafts along cliff faces to assist in migration during spring and fall.

How to find

- Ask local birders for the location of important migratory stopover areas. Many of the best sites are found within 2 km of Lake Ontario and Lake Erie.
- Topographical maps and aerial photographs may be used to find natural habitats close to the Great Lakes that may be used by migratory landbirds.

4.4.8 Raptor winter feeding and roosting areas

Open fields, including hayfields, pastures, and meadows that support large and productive small mammal populations (mice, voles) are important to the winter survival of many birds of prey. Such fields usually have a diversity of herbaceous vegetation that provides food for mammals. Scattered trees and fence posts provide perches for hunting birds. Windswept fields in more open areas that are not covered by deep snow are preferred by raptors because hunting prey is easier. The best roosting sites will likely be found in relatively mature mixed or coniferous woodlands that abut these windswept fields. Some species, such as northern harriers and short-eared owls, roost in large grassy fields. Some feeding and roosting sites support many birds, especially in years when northern species are numerous. In areas with few remaining forested areas, woodlots with dense conifer cover may support numerous roosting birds, especially long-eared owls. Highway corridors appear to attract many hunting raptors throughout the year, because these areas are open and the vegetation is relatively low, making hunting easier.As with waterfowl nesting habitat, protection of large areas of potentially suitable habitat will increase the probability of including significant raptor winter feeding and roosting areas within a Natural Heritage System.

How to find

- Residents are most likely to know where these habitats are found. Local naturalists may know the locations of winter concentrations of raptors.
- If a Christmas bird count (CBC) is conducted in the planning area, the compiler of the CBC data should be contacted to see if there are significant concentrations of wintering raptors.
- Farmers in areas of potential habitat often know when and where concentrations of raptors are found on their property.
- Use aerial photographs to locate open field areas next to woodlands comprised of at least some large trees. Prime areas would be hayfields, old fields, and pastures.
- Field investigations in potential areas should be conducted after first accumulation of snow. Usually, raptors are easily seen from roads.

4.4.9 Wild turkey winter range

Since most of its feeding is on the ground, the wild turkey's ability to move and forage freely is critical to its winter survival. Wild turkey will use fields and pastures, feeding on weed seeds and waste grain if the snow is not too deep. The birds do not stray too far from dense conifer cover. Dense coniferous forests provide the best winter habitat because they minimise snow accumulation on the ground and provide protection from the cold and predators. Coniferous stands used by turkeys are usually on valley floors or lower slopes. Hemlock stands appear to provide the best thermal protection and are often used during severe weather.

Wild turkey always roost at night for protection from predators. They prefer to use the largest conifers for roosts. Favoured roosts are normally found close to winter food supplies, which often includes agricultural fields where they can scratch for seeds left over from harvesting. Acorns are another favoured food. Wild turkeys readily move to new food sources and may change roosting sites from year to year. However, most significant winter roost sites will be used year after year.

The presence of groundwater seeps in the forest enhances wild turkey winter habitat because they melt the snow and expose food in the form of foliage and invertebrates. The best seeps are found on slopes with southern aspects that have increased exposure to sunlight, resulting in reduced snow depth and increased food availability. Turkeys also drink water regularly, so the presence of seeps or open watercourses is essential.

Wild turkey do not use winter range areas consistently over time. Use appears to depend on food supply conditions and availability of coniferous cover. Where coniferous cover is limited, they may use the same roosts more frequently. The most consistently used areas have stable, abundant, and high quality food sources located nearby (cornfields, oak trees). Those sites that have consistent use year after year would be considered significant.

How to find

- Ask the OMNR biologist for the location of important winter turkey habitat. Many OMNR offices have been conducting post card surveys to determine the distribution of birds. Farmers may have observed wild turkey feeding in their fields and be aware of potential habitat in adjacent areas. Landowners may also know where groundwater seeps occur.
- Use FRI maps in conjunction with aerial photographs to identify older coniferous or mixed woods with a good proportion of conifers and/or oaks. Stands of large conifers can often be identified from aerial photographs, these are areas are most likely to be used. In some areas, there is a shortage of coniferous forest and these pockets of conifers may be used. Birds may be forced to roost in hardwoods when conifers are rare.
- Conduct field investigations of most likely areas during winter. Flocks of feeding birds may be observed and winter roosts will usually be in the near vicinity.

4.4.10 Turkey vulture summer roosting areas

Turkey vultures like to roost on rocky cliff ledges and large, dead or partially dead trees, preferably in undisturbed areas, and often near water. Preferred day roosting areas appear to be open areas where the birds can easily take flight or sunbathe. Cliff ledges have excellent rising air currents that are conducive for flight and soaring. Significant sites are those that are used consistently year after year.

How to find

- Ask OMNR staff, local naturalists, and cottage owners for help in locating these areas.
- Use topographical maps in conjunction with aerial photographs to find areas with steep relief. Further examination of aerial photographs might reveal cliff areas with trees on the summit.
- Conduct field investigations on warm summer days after rainy periods, when birds frequently perch at roosts with outstretched wings. Copious amounts of whitewash (excrement) may be present at popular roosts.

4.4.11 Reptile hibernacula

Some species of snakes and turtles overwinter in sizeable concentrations in sites known as hibernacula. These sites are often in animal burrows, rock crevices, and other areas that enable the animals to hibernate below the frost line and often in association with water to prevent desiccation. Frequently hibernacula are found among broken rocks at the base of cliffs or in karst areas because these landforms provide an abundance of suitable subterranean crevices. In fall, snakes and turtles usually make a gradual movement toward their hibernacula and may be observed basking in groups close to the hibernacula. In spring, many snakes may emerge together and usually remain close to the hibernacula for a few days before dispersing.

Few hibernacula are known and they are normally very difficult to find. Radiotelemetry studies may be required to locate them. Since hibernacula have ideal microclimate conditions, they are very important to long-term sustainability of local populations; therefore, a reasonable amount of effort should be made to find these sites. Searches can be focused near sites where snakes or turtles have been observed. The assistance of groups of volunteers might be enlisted to search the most likely locations at the best times of the year.

How to find

- Ask the OMNR ecologist for the location of potential reptile hibernacula. Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites.
- The *Herpetofaunal Atlas* should be referred to. The records are mostly from observations during the summer. However, the records may reveal what species are most likely to inhabit the area, and Appendix G can be referred to for their preferred habitat.
- In spring, search any place where numerous snakes or turtles are encountered within a small area in less than a couple of hours. For snakes, prime spots to check are around slabs of broken or fissured bedrock, talus slopes, abandoned houses, and other places that provide access to subterranean areas. For turtles, prime areas are bogs and oxbows of rivers.
- Naturalists may provide assistance, especially for the more uncommon species.
- Consider conducting a public survey among residents and animal control professionals. In spring, some people observe the emergence of snakes from hibernacula on their property.

4.4.12 Bat hibernacula

Many species of bats overwinter in caves or abandoned mines. These winter hibernacula must have interior air temperatures slightly above freezing, relative humidity levels above 90%, and sufficient space for roosting. Preferred hibernacula are usually deep caves or abandoned mines, with remote and restricted openings with sufficient space for entry by flight. Flowing water helps moderate temperature and maintain sufficient humidity inside the cave. Largely because of their intolerance of disturbance, large, open caves and crevices are rarely used by bats in winter.

Hibernacula are relatively scarce and therefore large numbers of bats from several thousand square kilometres converge on certain sites every year. These populations are extremely vulnerable if these main hibernacula are altered, destroyed, or disturbed during critical periods. Research has shown that disturbances in winter hibernacula are a major mortality factor. Bats must wake periodically during hibernation. This requires a considerable amount of energy obtained from the conversion of fat reserves. Any unnecessary disturbance further stresses the animals. Even minor disturbances can have a lethal impact. Aroused individuals produce an alarm response and a chain reaction, triggering the arousal of many others.

How to find

- Natural caves are scarce in Ontario. Large caves are usually found in limestone areas where underground water dissolves the rock and produces chambers (karst topography). Geological maps indicate the presence of limestone formations and the potential for caves. In southern Ontario, most caves and karst topography are found in the upper Ottawa Valley and along the Niagara Escarpment, including the Bruce Peninsula. Ask OMNR ecologists in these districts for locations of known hibernacula or for potential candidate sites.
- Contact the Ontario Ministry of Northern Development and Mines to obtain locations of abandoned mines in the planning area. They can be checked to determine if they are still open or have been sealed off.
- Some faculty members in university biology departments may know locations of hibernating bats. Contact the OMNR ecologist for names.
- Some recreationists explore caves and may know caves with hibernating bats. Contact the Sierra Club.

4.4.13 Bullfrog concentration areas

Bullfrogs are primarily aquatic and found in marsh habitat. They require permanent waterbodies for survival. Bullfrog tadpoles may take up to several years before undergoing metamorphosis. Numbers of bullfrogs in a wetland can vary drastically depending upon geographical location. Populations on the Canadian Shield tend to be smaller than those in located off the shield.

Bullfrogs will congregate in the early summer and males will chorus for breeding purposes. Populations have declined in Ontario due to habitat destruction and exploitation.

How to find

- Consult the *Ontario Herpetofaunal Summary* for distribution of bullfrogs. In addition, the CWS (Burlington) may have documentation of bullfrog populations through Amphibian Road Surveys, Backyard Amphibian Call Count.
- Ask the local OMNR ecologist, biologist for known populations.
- Use 1:50,000 NTS maps or aerial photography to locate marsh habitat
- Consult wetland evaluations for documented populations.
- Surveys could be conducted from mid-May to late June to locate chorusing population.

4.4.14 Migratory butterfly stopover areas

In fall, during the southward migration, some species of butterflies (monarchs) stop to feed, rest, or wait for inclement weather conditions to pass before they attempt to cross Lake Ontario, Lake Erie, and Lake Huron. Preferred stopover areas provide an abundance of preferred nectar plants, as well places for shelter and sunning.

How to find

- Ask the local OMNR ecologist, local naturalists, and butterfly experts for help in locating these areas. Agriculture Canada (Ottawa) has entomologists on staff with expertise in butterflies.
- Use aerial photographs to find fields and other open areas within 5 km of Lake Ontario, Lake Erie, or Lake Huron shorelines.
- Conduct field investigations of selected areas in mid September, preferably just after rainy periods

5 Identifying Rare Vegetation Communities or Specialised Habitats for Wildlife

5.1 Definitions

Rare vegetation communities include:

- areas that contain a provincially rare vegetation community
- areas that contain a vegetation community that is rare within the planning area

Specialised habitats include:

- areas that support wildlife species that have highly specific habitat requirements
- areas with exceptionally high species diversity or community diversity
- areas that provide habitat that greatly enhances a species' survival

5.2 Ecological function/effects of loss

5.2.1 Rare vegetation communities

Rare vegetation communities often contain rare species, particularly plants and small invertebrates, which depend on such habitats for their survival, and cannot readily move to, or find alternative habitats. Some communities such as tall-grass prairies and savannahs were never widespread in the province. Now these habitats and many of the species they support are rare or threatened because of changes to the landscape. Often these habitats are very sensitive to changes in moisture or amount of vegetative cover.

The ecological function of these rare communities is to ensure that species that depend upon them will maintain viable populations and biodiversity of communities on the landscape. Loss or degradation of rare habitats will lead to an increase in the numbers of species that are rare, vulnerable, threatened, and endangered and, over time, to a decrease in biodiversity within the planning area and province. Protection of rare vegetation communities now, will protect their associated species and reduce costs of future species recovery programs.

5.2.2 Specialised habitats for wildlife

Certain wildlife species have highly specific requirements for their survival. For example, the larvae of some butterfly species require specific plants, many of which are confined to just a few small areas. Many species of birds and mammals require tree cavities in which to nest or find shelter. Salamanders require moist, sheltered, and temperate habitats for survival. Large fallen logs that are moss-covered and in an advanced state of decomposition provide such specialised habitat for them. Sometimes the presence of a specialised habitat may not mean life or death to the animal in the short-term, but it may

Figure 5.1. Bogbean buckmoth, specific to eastern Ontario fen habitat, are known in only in two locations in Ontario.

affect the long-term survival of them or their offspring. For example, black bears depend heavily on acorn crops to build fat reserves required for hibernation. If this food source is not available, their survival through winter may be jeopardised or females may lose their cubs.

Often the use of a specialised habitat is seasonal. For example, moose use at least two specialised habitats in early summer. Mineral licks provide specialised habitat that allows these animals to replenish sodium levels that have been seriously depleted during the winter months. Aquatic habitat that contains abundant sodium-rich plants in early summer is also critical to moose.

The ecological function of specialised habitats is to enhance and, in some cases, ensure the survival of the associated wildlife species that depend on them. Protection and maintenance of these areas will contribute to higher biodiversity within the planning area. Loss or degradation of these areas and features could seriously stress and even eliminate the wildlife populations that intrinsically depend upon them.

5.3 Identification of potentially rare vegetation communities or specialised habitat for wildlife

Since many rare vegetation communities and specialised habitats for wildlife exist within the other six natural heritage components, emphasis should be on finding habitats outside these areas. The following information sources can help the planning authority identify potentially rare vegetation communities and specialised habitats.

- Use the information outlined in Table 3-1 and discussed in Section 3.2 to identify these potentially significant habitats.

- The OMNR ANSI Site District and inventory reports can be particularly useful for identifying rare vegetation communities. For example, they identify provincially, regionally, and locally significant wetlands communities such as bogs and fens, and rare vegetation associations for the Site Districts they cover.

- Refer to Table I-3 in Appendix I for a list of information sources for identifying rare vegetation communities or specialised habitats for wildlife. The habitat matricesin Appendix G describe the habitat requirements of species associated with specialised habitats.

5.3.1 Potentially rare vegetation communities

A list of rare vegetation communities for southern Ontario (Site Regions 6 and 7) has been prepared and described in a document entitled "*Natural Heritage Resources of Ontario: S-ranks for Communities in Site Regions 6 and 7*" (Bakowsky, 1996). This document is found in Appendix J. All of the vegetation communities are listed for southern Ontario, including marshes, swamps, bogs, fens, beaches, sand dunes, barrens, alvars, prairies, savannahs, and forests. Dominant species and a site description based largely on soil moisture and texture are used to discern communities. The rarity of each community and its presence or absence in Site Regions 6E and 7E of southern Ontario are provided.

The Natural Heritage Information Centre also has a web site (see Appendix F), that can be checked to see if there are any updates.

The Ecological Land Classification for Southern Ontario (Lee et al. 1998), provided more specific details for vegetation communities in southern Ontario, including: descriptions of how each community is broadly defined; its status and distribution; the principle ecological factors that have helped to determine communities; topography and soils of the communities; the dominant and associated species; and sometimes the distribution of vegetation within the community.

Some vegetation communities described in these publications are difficult to identify because considerable field experience is required. However, they provide an excellent starting point for the identification of rare vegetation communities. Appendix L describes a practical approach for identifying rare vegetation communities using the Ecological Land Classification (ELC) system.

A summary of the approach to the identification of potentially rare vegetation communities is outlined below.

- Some provincially and regionally significant vegetation communities such as alvars and prairie remnants have already been described and mapped by the OMNR. Table 1 in Appendix M describes the locations of some of these rare vegetation communities. Ask the OMNR ecologist for locations of rare vegetation communities found within the planning area.
- Map (preferably at 1:10,000 scale) all these known rare vegetation communities.

- Use the *Ecological Land Classification for Southern Ontario* and the list of rare communities found in southern Ontario (Appendix J) as reference, and then use aerial photographs to locate and map the distribution of potential rare communities.
- Ask the OMNR ecologist, local botanists, and CAC members to help to verify the presence of suspected rare communities.
- Determine the potential rarity of a vegetation community by its degree of representation within the planning area.

5.3.2 Specialised habitats for wildlife

Below is an approach to identification of specialised habitats for wildlife.

Figure 5-2. Monarch caterpillars feed strictly on milkweed.

- find out what is already known about these habitats. The OMNR ecologist will know locations of previously identified specialised habitats in the municipality. In some areas, few will have been documented, but there may be some information about the following habitats:
- old-growth forest
- areas known to support an unusually high diversity of species or vegetation communities
- raptor nesting habitat
- areas with concentrations of cavity trees
- moose or bear foraging areas
- map all these known specialised wildlife habitats, preferably at 1:10,000 scale.
- refer to the wildlife habitat matrices(Appendix G). These tables provide lists of species that use specialised habitats.
- Encourage the assistance of knowledgeable people to help find specialised habitats. A CAC could work on or coordinate such a task. Local naturalists are one of the best sources of information about such habitats because they spend much time exploring natural areas, and know the local flora and fauna. Landowners with potentially significant wildlife habitats on their property might be able to provide additional information.
- Sub-section 5.4.2 provides a detailed description of how to find specific specialised habitat.

5.4 How to find some rare vegetation communities or specialised habitats for wildlife

The following sections provide detailed descriptions of rare vegetation communities and specialised habitat for wildlife. They are provided to familiarise the reader with these vegetation communities and habitats so they will be able to recognise them. Most of these habitats, especially the specialised habitats for wildlife, have not been identified and mapped, and finding them can be difficult. Some of these habitats may not exist in the planning area, while some habitats may exist, but the species that normally use it may not occur. For example, there may be springs and seeps that are not used by wintering wild turkeys.

Each rare vegetation community and specialised habitat description is accompanied by some specific suggestions on how to find them. The following is a list of information sources that can be used to find these habitats:

- Table 3-1, general information sources required to find significant wildlife habitat.
- Appendix F, list of agencies and their areas of expertise (these include web sites for updated information).
- Appendix I, information sources for the identification of specific significant habitat.
- Appendix G, wildlife habitat matrices, with lists of species that use specialised habitats.
- Appendix J provides a list of all the rare vegetation communities in Site Regions 6 and 7.
- Appendix M describes the locations of all known rare vegetation communities.
- Appendix L provides a suggested approach for using the Ecological Land Classification system to identify rare vegetation communities.
- Seek advice from the local OMNR ecologist for locations of rare or specialised habitats.
- Involve the CAC and local naturalists in searches for rare and specialised habitats.

5.4.1 Rare vegetation communities

Refer to Table M -1 in Appendix M for a list of known locations of provincially and regionally rare vegetation communities of southern Ontario.

5.4.1.1 Alvars

Alvars are naturally open areas of thin soil over essentially flat limestone, dolostone or marble rock. They support a sparse vegetation cover of shrubs and herbs, and trees are often absent or scattered. In spring, alvars may have standing water; in summer, soils can become very hot and dry. Vegetation is adapted to these extreme variations in temperature and soil moisture. Some of the characteristic plants that can indicate the presence of alvar communities include spring forget-me-not, long-plumed purple avens, false pennyroyal, small skullcap, and narrow-leaved vervain. Table N–1 in Appendix N is a list of alvar plant indicator species.

Approximately 85% of alvar sites and more than 90% of alvar landscape area in the Great Lakes region are in southern Ontario (Catling & Brownell, 1995). Concentrations of alvars are found in the following areas: Manitoulin Island, Bruce Peninsula, Lake Erie Islands, Carden Plain, Napanee Plain, and the Smiths Fall Plain. Many alvars have been identified in southern Ontario. Refer to Appendix L for locations of known alvars.

Figure 5-3. Alvar, Misery Bay, Manitoulin Island.

How to find

- Use soil reports and maps and aerial photographs to locate open areas of flat topography, with shallow soils over limestone bedrock.
- Check "Barren and Scattered" areas on FRI maps with corresponding aerial photographs.
- Refer to the list of plant species that are considered indicators of an alvar (Table N–1 in Appendix N).
- Published alvar reports (e.g. Catling and Brownell 1995, etc.)

5.4.1.2 Tall-grass prairies

Tall-grass prairies in Ontario are usually small remnants (< 1 ha) located mainly in the southwestern part of the province. High quality prairies have few trees, non-native plant species, and a large proportion of provincially significant species. A history of burning eliminates or controls invasion by woody shrubs and maintains this rare community. Prairie habitats are very susceptible to natural succession and must be frequently disturbed by such natural processes such as fire in order to be maintained. Many of the prairie remnants that remain have invasive plant species.

Indicator species are usually the dominant grasses including big bluestem, Indian grass, switch grass, and tall cord grass. Soil depth is variable; soils are usually fine-textured, ranging from dry-mesic sands to wet-mesic sandy loams, over limestone bedrock. Table N-2 of Appendix N is a list of Tall-grass prairies and Savannah indicator species.

Many prairie remnants have been identified. In Site Region 7E prairie remnants have been identified on the following landforms: Horseshoe Moraines, Caradoc Sand Plains, Bothwell Sand Plains, St. Clair Clay Plains, Norfold Sand Plain. In Site Region 6E prairie remnants are found on the Peterborough Drumlin Field. See Appendix M for locations of known provincially or regionally significant sites.

How to find

- Use aerial photographs in conjunction with County Soil Survey reports and maps, and FRI maps to find open, treeless areas of non-cultivated land.
- Early writings or maps documenting the location of aboriginal communities may help to find remnant prairies. The frequent burning in these areas helped to maintain these habitats.
- Maps of vegetation communities have been prepared from the original surveyors' notes, and these may identify where prairies originally occurred. These are available for southern Ontario from the Ministry of Citizenship, Culture, and Recreation.
- Refer to Table N–2 in Appendix N for a list of tall-grass prairie plant indicator species.

5.4.1.3 Savannahs

Savannahs are characterised by widely-spaced, open-grown trees producing a cover of 60% or less growing in association with an assortment of grasses and forbs that are characteristic of prairie communities. Soil depth is variable and is usually underlain by limestone bedrock. Soils are often silt loams and Farmington loams. In the spring, they are frequently saturated and internal drainage is restricted due to the underlying bedrock. Conversely, in mid to late summer, soils dry out, often creating drought-like conditions. Fire maintains these communities by controlling the invasion of woody shrubs and non-native species of grasses.

The trees are usually oaks and hickories, mainly black oak, bur oak, and shagbark hickory. Black oak is the dominant species in southern Ontario savannahs. On dry sites, other dominant species include white oak and red cedar. Some dominant or indicator plant species of oak savannahs include big bluestem, hair grass, rough-leaved dogwood, wild bergamot, gray-headed coneflower, nodding wild onion, fragrant sumac, and common juniper. Poorly-stocked, and barren and scattered stands as depicted on FRI maps, should not be considered savannahs unless they have the appropriate canopy and understorey characteristics. Refer to Table N–2 of Appendix N for a list of savannah indicator species.

Many savannahs have been identified. These communities are found mainly in southwestern Ontario. In Site Region 7E they are found on the following landforms: St. Clair Clay Plains, Horseshoe Moraines, Norfolk Sand Plain, and Erie Spits. In Site Region 6E they are found on the Oak Ridges Moraine. See Appendix M for locations of some provincially or regionally significant savannahs.

How to find

- Use aerial photographs and soil survey reports to find open areas of flat topography, with shallow soils over limestone bedrock, and scattered trees.
- Check "barren and scattered" areas on FRI maps with aerial photographs.
- Check the distribution maps of some savannah indicator species, such as black oak.
- Refer to Table N-2 in Appendix N for a list of savannah indicator species.

5.4.1.4 Rare forest types

Forests are treed communities with greater than 60% canopy closure. A deciduous forest is a forest in which deciduous tree species are more than 75% of the total tree cover. In Site Districts 6E and 7E, there are several rare deciduous forest types consisting mainly of regionally or locally uncommon tree associations or supporting some provincially or regionally rare trees. A mixed forest has greater than 60% canopy closure, and both coniferous and deciduous tree composition, with each component forming greater than 25% canopy cover. A coniferous forest has greater than 75% conifer composition. Potentially rare forest community types are listed in Appendix J.

Reports produced by the Ontario Soil Survey can further help in finding rare forest habitats. Soil formation, soil depths and textures, drainage, relief, and indigenous forest associations of the counties of southern Ontario are summarised. This information can be used to narrow the search for certain forest types. These soil surveys and maps are available from the Ontario Ministry of Agriculture, Food and Rural Affairs in Toronto. More information about landforms, their formation and distribution, can be found in the Physiography of Southern Ontario (Chapman and Putnam 1984). Finally, Trees in Canada (Farrar 1995) is a good reference textbook for information about the habitats and distribution of trees in the province.

The forest communities listed in Appendix J are those that may be significant at the provincial level. Planning authorities may wish to identify additional forest community types that may be significant within their jurisdiction. Certain community types that are common within the province or site district may be rare within a municipality. This may occur if the municipality is at the periphery of a vegetation community's distribution range, or if land-use practices have resulted in the loss of a high proportion of the community.

How to find

- Use FRI maps to locate potentially rare tree associations and to determine relative rarity of existing associations within the planning area. FRI maps note tree composition of forest stands.
- Use Ontario Soil Survey reports and maps to determine the range of specific soils types, textures, and depths in the planning area. This information, used in conjunction with Appendix J and the ELC for southern Ontario, FRI maps, and Trees in Canada can help to indicate areas with good potential to support rare communities.

- Check the OMNR site district report(s) that apply to the municipality for descriptions of potentially rare forest types. Site district and inventory reports often include detailed site descriptions that can narrow the search and they identify landforms that may support some of these forest types.
- Contact the director of the Ontario Tree Atlas Program at the Arboretum, University of Guelph, for information about the location of locally and regionally uncommon or rare trees in southern Ontario. Volunteers have collected data on tree species distribution in southern Ontario, within 10 x 10 km blocks.
- Conduct field investigations of the most likely areas.

5.4.1.5 Talus slopes

These habitats are characterised by blocks of limestone/dolostone, sandstone, or granite of variable size, found at the base of cliffs of steep slopes. Often substantial amounts of rock rubble accumulate through the formation and weathering of cliffs. These sites have coarse rocky material occupying greater than 50% of the ground surface. Soils are shallow, have little mineral material, and are primarily made up of organic debris. In general, vegetation is sparse and patchy.

Talus slopes provide specialised habitat (hibernacula) for some snakes. The accumulated broken rocks at the base of the cliffs frequently provide subterranean entry points for snakes that must hibernate below the frost line. Often these slopes support diverse vegetation communities, particularly if they have a southern exposure, basic soils, and presence of some water.

How to find

- Use topographical maps to locate areas of sharp relief that could be searched. Sometimes abandoned quarries will provide talus habitat.
- Check geological maps for areas of limestone outcrops.

5.4.1.6 Rock barrens

Rock barrens are open to moderately-treed sites (up to 60% crown coverage) characterised by exposed bedrock and very shallow soils (less than 15 cm). Precambrian barrens, including the more common metamorphic types, and the less common granitic and marble types are normally found on ridges and other elevated, glacially scoured sites. Paleozoic barrens, including limestone/dolostone and sandstone types are generally flat.

In southern Ontario they are largely restricted to Site Region 6E, where they are found on limestone plains adjacent to the Precambrian Shield. Good examples of metamorphic/granitic rock barrens are found on the northern part of the Frontenac Axis in eastern Ontario. Extensive limestone rock barrens (also referred to as dolostone pavement) are found on Manitoulin Island, the Bruce Peninsula and the Napanee Limestone Plain. Sandstone barrens are much rarer. Small examples occur on the Nepean Sandstone Formation in eastern Ontario.

Several provincially rare species are associated with granitic rock barrens including pitch pine found only in Leeds County, winged sumac, small prickly pear cactus, bear oak, Case's ladies' tresses, sharp-leaved goldenrod, and several grasses and sedges. Precambrian rock barrens often attract mammals such as red fox, coyote, and black bear that come to forage on berries and insects found under rocks. Flat rocks on many barrens also provide important foraging and cover habitat for many snakes and five-lined skinks. They may also function as animal movement corridors, especially in areas with numerous wetlands and ponds.

How to find

- Use aerial photographs to locate open areas and large rock outcrops with little or no vegetation.
- Check distribution maps for some of the species listed above.

5.4.1.7 Sand barrens

Sand barrens are open (tree cover < 25%) herbaceous communities occurring inland on dry, deep sand deposits. These rare vegetation communities are dominated by species such as bracken fern, hay sedge, deep-green sedge, and New Jersey tea. Mosses and reindeer lichen form a substantial component of the vegetation cover. Vegetation is usually low to the ground, sparse and patchy, and there is much exposed mineral soil. These rare habitats are known to occur in Site Region 6E on the Iroquois Plain. See Appendix M for a description of some of their locations.

How to find

- Use County Soil Survey reports and maps to locate areas with deep sandy soils.
- Use aerial photographs to locate open areas with little noticeable vegetation cover in parts of municipality with deep sandy soils.

5.4.1.8 Great Lakes dunes

Great Lakes dunes are open vegetation communities occurring on sand dunes along the shores of the Great Lakes. Soils are severely-drained calcareous sands. Further back from more active shoreline areas, the more stabilised sand has greater cover of trees and shrubs. Dominant tree species include eastern cottonwood, red cedar, white pine, red pine, black oak, red oak, and white oak. Characteristic grasses include beachgrass, Canada wild rye, switch grass, and little bluestem; characteristic plants include tall wormwood, rock sandwort, and starry false Solomon's-seal. The beach communities consist mainly of sea rocket, seaside spurge, Russian thistle, and horsetail, among other species.

Several important dune areas have been identified and include: along Lake Huron shorelines at Manitoulin Island, Sauble Beach, McGregor Point, Inverhuron, Grand Bend, Pinery, Ipperwash; along Lake Erie shorelines at Point Abino, lesser remnants at Fish Point, Port Burwell; and along Lake Ontario at Burlington Beach, Weller Bay, Prince Edward Peninsula. Other dunes are found in Georgian Bay and include the Mississagi

River mouth, Wasaga Beach, and the Penetang Peninsula. See Appendix M a description of the locations of some provincially and regionally significant Great Lakes dunes.

How to find

- Use County Soil Survey reports and maps in conjunction with aerial photographs to locate areas of sand along the Great Lakes.

5.4.2 How to find specialised habitats for wildlife

Most specialised habitats have not been formally identified and mapped by any agency. The planning authority can identify many of them by working with knowledgeable people who know the natural heritage features and areas of the municipality (local naturalists, CAC, OMNR, landowners). OMNR site district and inventory reports and wetland evaluations, as well as consultant and naturalist reports, are good sources of written information.

Many of the specialised habitats described below can be identified using the information discussed in Section 3.2 and listed in Table 3-1, plus some knowledge of the natural history of their associated species and the unique physical structure of each habitat. Many specialised habitats are likely to exist in most municipalities. The following is a description of several potentially specialised habitats, their value to wildlife, and how to find them.

5.4.2.1 Habitat for area-sensitive species

Some wildlife species require large areas of suitable habitat for their long-term survival. This seems to be particularly true for larger mammalian carnivores such as gray wolf, lynx, and fisher. On a smaller scale, many birds require substantial areas of suitable habitat for successful breeding and their populations decline when habitat becomes fragmented and reduced in size. Over time, competitive species, predators, and nest parasites (primarily the brown-headed cowbird) reduce productivity of these birds. See the habitat matrices in Appendices C and G for a list of area-sensitive bird species of forested and open areas such as grasslands.

The larger and least fragmented forest stands within a planning area will support the most significant populations of forest-area sensitive birds. Forests should cover about 30% of the regional landscape to provide minimal conditions for these species and there should be several large woodlands (30 to 100+ ha) present to provide enough suitable forest-interior bird nesting habitat. Forests comprised of a mainly closed canopy of large trees and a variety of vegetation layers tend to support a greater diversity of species because of the broader range of habitats they provide.

The minimum forest habitat for area-sensitive species is at least 100 metres from any edge habitat. Edges can have adverse effects on forest-interior habitat. For example, some forest birds may nest near or in forest edge habitat and then suffer reduced reproductive success because of nest predation and parasitism.

For area-sensitive grassland bird species, large grassland areas are required as they are more likely to be buffered from disturbance, more likely to increase the distance of nesting habitat to woody edges (thereby reducing nest predation and parasitism), and provide more opportunities for nesting. An endangered species in Ontario, the Henslow's sparrow, appears to prefer tall-grass fields of at least 30 ha. Sufficient habitat is required for several breeding pairs before the habitat will be used, although one pair of birds may only use an area of 1 to 2 ha in size. Even more common grassland species such as bobolinks, savannah sparrows, and grasshopper sparrows are more abundant as breeding birds in grasslands of at least 10 ha. Grasslands with a variety of vegetation structure, density, and composition tend to support a greater diversity of grassland nesting birds because different species require different nesting habitat.

Protecting significant woodlands as suggested in the *Natural Heritage Section of the Provincial Policy Statement*, will also maintain some critical habitat for area-sensitive forest species. The significant woodland component is closely linked to this important significant wildlife habitat. The largest, least-disturbed grasslands might also be identified for their value to area-sensitive grassland species and provision of further landscape diversity. Each planning area should protect representative examples of these habitats.

How to find

- Use FRI maps together with aerial photographs of the municipality to identify potentially significant forest-interior habitats.
- Use aerial photographs to determine the amount of contiguous forest cover and potential grasslands, the spatial arrangement of forest and grassland fragments, and the extent and nature of edge habitat within the planning area.
- Planning authorities with their resource data in a GIS system can make queries of forest stands based on size.
- Ask local birders for local woodlands and grasslands that support abundant and species rich populations of area-sensitive species. These people may know many of the most important areas. Appendix C provides a list of area-sensitive birds and important references.
- Contact the Canadian Wildlife Service (CWS) for the location of forest bird monitoring sites and names of volunteers who might assist the planning authority in locating important areas.
- Bird Studies Canada may be of assistance. They conducted a 3-year study of 287 woodlots to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species.

- Conduct field investigations of the most likely looking areas in spring and early summer when birds are singing and defending their territories.

5.4.2.2 Forests providing a high diversity of habitats

Forests with a variety of vegetation communities and dominant tree cover are most likely to have the highest diversity of plant and wildlife species. Complexes of upland and wetland habitats also may have high diversity.

Many species of wildlife such as squirrels, and cavity-nesting birds like pileated woodpeckers, barred owls, and wood ducks use large trees with hollow cavities to bear and raise young. These trees can also provide resting or loafing habitat for mammals like raccoon and porcupine. Refer to the habitat matrices in Appendix G for the habitat preferences of species that depend on tree cavities. Older forest stands usually have more cavity trees and support a higher diversity of species than young stands. Best sites contain a mix of large and small tree cavities. Cavities in living trees are generally better than those in dead trees because they last longer. Some tree species make better cavity trees than others do. For example, species such as red pine or white birch break down very quickly and are of limited use for cavities.

Very tall trees, such as white pine, that grow above the main canopy (supercanopy trees), provide important habitat for birds of prey, that may use these trees for nests, roosts, and hunting perches.

Forests with numerous vertical layers of vegetation also contribute greatly to site diversity because of the many microhabitats they provide for wildlife. In addition, an abundance of ground structure such as large fallen logs and leaf litter further enhances a site's ability to support wildlife. Fallen logs are essential habitat for some salamanders, members of the weasel family, certain woodpeckers, and many invertebrate species.

How to find

- Examine FRI maps for older forest stands (average tree age greater than 100 years old or the oldest stands in the planning area), forests with several stand types, and stands with composition consisting primarily of trembling aspen, largetooth aspen, beech, basswood, white cedar, and white pine. These tree species readily form cavities that are important to wildlife.
- Use aerial photographs to locate the largest, contiguous forests in the planning area. In addition, forest stands that are closely associated with other forest stands usually provide greater diversity than isolated stands.

5.4.2.3 Old-growth or mature forest stands

Although definitions of old-growth forest vary depending on tree species, generally these sites are characterised by having a large proportion of trees in older age classes, many of them over 120 to 140 years old. Other features include: a broad spectrum of tree sizes with some very tall trees, an uneven canopy with scattered gaps due to fallen trees and large limbs, and abundant fallen logs in various stages of decomposition. These older, relatively undisturbed forests usually support a high diversity of wildlife species.

Old-growth forest stands are rare throughout the province, particularly in southern Ontario, largely due to past logging practices. Most candidate sites will likely be small stands that have experienced little or no forestry management.

How to find

- Ask OMNR foresters for locations of old growth candidate sites in the planning area.
- Examine FRI maps to locate the oldest stands and use aerial photographs to verify FRI information.

5.4.2.4 Foraging areas with abundant mast

Over 75 species of birds and mammals consume fruit and nuts within the Great Lakes-St. Lawrence forest region and abundant supplies can enhance their survival and productivity. In summer and fall, black bears search for areas of abundant food. The most important areas are forests containing numerous large beech and red oak trees that supply the energy-rich beechnuts and acorns that bears prefer. These sites are especially important in the fall because the animals are building fat reserves for hibernation. Other animals such as white-tailed deer that remain active throughout winter may also rely on supplies of nuts to build fat reserves. In summer, in more open areas, large patches of berry-producing shrubs (blueberries, raspberries, huckleberries) provide important feeding habitat for a variety of animals and birds. Black cherry, mountain ash, and apple trees also may attract wildlife. If these food sources are unavailable or drastically reduced, bears may wander into human communities in search of food.

How to find

- Ask OMNR staff for locations of known feeding areas as well as sites with a high composition of mast-producing trees. Landowners and local hunters may also know of important sites, particularly more visible "bear nests" or claw marks in beech and oak trees.
- Use FRI maps to locate forest stands with high proportion of beech and red oak trees.
- Use aerial photographs to locate large bedrock outcrops where shrubs producing berries are often found. Forest openings, old fields, and utility corridors are often excellent sites.

5.4.2.5 Amphibian woodland breeding ponds

These ponds are used for breeding by several species of frogs and salamanders. Such water bodies may be small and ephemeral but nevertheless, important to local amphibian populations, especially if they provide the only suitable habitat in the area.

The best breeding ponds are unpolluted, and contain a variety of vegetation structure, both in and around the edge of the pond, for egg-laying and calling by frogs. The best adjacent habitats are closed-canopy woodlands with rather dense undergrowth that maintains a damp environment. Moist fallen logs are another important habitat component required by salamanders. Sites with several ponds and/or ponds close to creeks are especially valuable.

How to find

- Ask the OMNR ecologist and biologist and local naturalists for locations of important woodland ponds. Local landowners may also provide assistance as they may hear springtime choruses of frogs on their property.
- Soil reports and maps may indicate presence of ponds by describing drainage patterns and locations of shallow soils over rock and relatively impervious soils (clay soils), physical characteristics that often lead to pond formation.
- Examine topographical maps to locate low-lying, poorly drained areas of the municipality.
- Ask CWS (Burlington) if amphibian-monitoring programs (amphibian call counts and backyard surveys) are being conducted in the planning area. If so, they can provide names of volunteers and areas surveyed.
- Contact Bird Studies Canada for information on their marsh-monitoring program.
- Conduct field investigations in spring; warm spring evenings in April are good times to listen for calling frogs to determine their relative abundance. For later-calling species such as green frog and bullfrog, late May and early June is more optimum timing.
- Refer to the Ontario Herpetofaunal Summary for historical records.

5.4.2.6 Turtle nesting habitat

In spring and early summer, turtles lay their eggs in areas that may be used year after year. Preferred nesting habitats are usually on relatively soft substrates such as sand or fine gravel that allow turtles to easily dig their nests, and are located in open, sunny areas (enhancing development). In general, the best nesting habitats are close to water and away from roads (less mortality of adults and hatchlings) and sites less prone to loss of eggs by predation from skunks, raccoons, and other animals.

Areas with numerous turtle nests are hard to find and it is unlikely that many such sites will be found. However, the following suggestions will help to narrow the search for prime areas.

How to find

- Use Ontario Soil Survey reports and maps to help to find suitable substrate for nesting turtles (well-drained sand and fine gravel).
- Check the Ontario Herpetofaunal Summary records for uncommon turtles; location information may help to find potential nesting habitat for them.
- Use aerial photographs and maps to narrow the search for prime nesting areas including shoreline beaches located near good turtle habitat (weedy areas of wetlands, lake and river shorelines), road embankments near turtle habitat, and stream crossings/culverts on water bodies.
- Conduct field investigations during prime nesting season near wetlands deemed to provide the best turtle habitat.

5.4.2.7 Specialised raptor nesting habitat

Several raptors, including ospreys, those nesting and hunting in forests, and several other woodland and grassland raptors require somewhat specialised nesting habitat for their long-term survival. For example, red-shouldered hawks prefer mature forests with closed canopies, near water. If the site remains undisturbed, they may continue to use the same nest or site in consecutive years. Osprey nest along lake shorelines as well as in wetlands close to productive fishing waters. Short-eared owls nest on wet ground in open areas, including marshes and wet fields with sufficient ground cover.

Shorelines of productive water bodies with numerous large conifers and/or deciduous trees and with extensive areas of shallow water (< 1 m) for fishing are prime nesting habitat for ospreys. Trees used for perching and nesting are large and sturdy, and provide birds with clear flight paths and good visibility.

Most woodland raptors require mature trees that are large enough to support the nest, full canopy closure, and a minimum of trees and shrubs in the understorey. Since these birds of prey hunt within the forest, an unimpeded flight zone under the canopy is required.

The presence of displaying or vocalising adults or active nests, is the most expedient approach to take when attempting to identify specialised habitat for these species. Also, the presence of inactive nests can indicate important raptor nesting habitat because some species may have several inactive nests within their nesting territory. see habitat matrices in Appendix G for descriptions of nesting habitats of raptor species and Appendix O for how to find and identify their nests.

How to find

- Use FRI maps and aerial photographs to identify the largest tracts of contiguous forest in the planning area. FRI maps indicate species composition and age of forest stands (two important factors in nesting habitat selection for several species of raptors, including red-shouldered hawk). To find potential osprey nesting habitat, focus on old shoreline forest stands first. FRI maps and aerial photographs may also be used to identify large (>75 ha) fields and meadows that may be suitable for short-eared owl nest sites.

- Use maps and aerial photographs to identify forests with few roads that tend to have less human disturbance. Use aerial photographs to identify areas of water within forested areas that may provide red-shouldered hawk nesting habitat.
- Ask the OMNR ecologist or biologist. They may be aware of locations of nesting raptors. Often osprey nests are reported to OMNR. In addition, these staff may know local naturalists that may be aware of the locations of raptor nests.
- Conduct field investigations from mid April to the end of May. The use of tape-recorded hawk calls can help to find raptor nests by eliciting calling responses from courting or nesting hawks.
- Short-eared owls may hunt with other raptors in winter seasonal concentration areas (open fields with abundant small mammals). If suitable nesting habitat is present, some birds may remain to breed.
- Check data from the red-shouldered hawk survey administered by Bird Studies Canada.
- Conduct aerial flights, concentrating on shorelines of lakes, large rivers, and marshes.
- Check the *Atlas of Ontario Breeding Birds* or *Rare Breeding Birds in Ontario* for species documented in your planning area.

5.4.2.8 Moose calving areas

Shortly before giving birth in mid-May, solitary cow moose move to areas providing isolation, cover, and escape paths from predators. Calving sites are usually slightly elevated areas. Islands and peninsulas seem to be preferred, but shorelines and upland areas are also used if they are relatively close to open water (100 to 500 metres). These sites are hard to find by field investigation because at this time of year moose are solitary and intentionally looking for secluded areas.

The OMNR has the greatest expertise in looking for and finding moose calving areas, as well as moose aquatic feeding areas and mineral licks briefly discussed below. OMNR biologists are aware of these specific habitat requirements. Very few calving sites will be known.

How to find

- Topographical maps used with aerial photographs will help locate potential habitats such as islands and peninsulas.
- Consult the OMNR biologist for known calving sites.

5.4.2.9 Moose aquatic feeding areas

From June through July, moose move as far as 30 km to consume large quantities of aquatic plants, especially subagent species, to replenish their bodies with sufficient sodium. They feed several times a day at preferred aquatic feeding sites. Ideal sites provide abundant food, particularly pondweeds, water milfoil, and yellow water lily, and have adjacent stands of lowland conifers to provide shade and hiding cover. Several moose may use prime sites.

How to find

- Use aerial photographs to identify bays, shorelines, and river and creek systems with aquatic vegetation.
- Contact the OMNR biologist for the locations of potential sites.
- Use FRI maps and aerial photographs to locate coniferous tree cover adjacent to potentially suitable areas.
- Conduct aerial flights in June and July to locate concentrations of moose or evidence of use (an OMNR protocol is available).

5.4.2.10 Mineral licks

In spring, moose seek mineral licks to consume sodium that is found in upwelling groundwater and the soil of these seepage areas. Mineral licks surrounded by forest cover and free of human disturbance may be used by large concentrations of moose for many years. These sites are rare, occurring most frequently in areas of sedimentary and volcanic bedrock. They rarely occur on granitic bedrock, except where the site is overlain by calcareous glacial till.

How to find

- Contact the OMNR biologist for the location of any known or potential areas. Local residents may also know the location of licks.
- Consider using a small aircraft to verify reported sites because mineral licks are uncommon; however these areas stand out because they are so trampled.

5.4.2.11 Mink, otter, marten, and fisher denning sites

These species are members of the weasel family. They are predators with large home ranges and must cover a large area in search of food (a male fisher may have a home range of 17.5 to 39 sq. km). Like most larger carnivores, they are rarely found in high densities, and have specific habitat components critical to their survival.

Mink prefer shorelines dominated by coniferous or mixed forests for feeding and denning. Dens are usually located underground, especially where shrubs and deadfalls provide more cover for dens and habitat for prey. They also den in abandoned muskrat lodges.

Since otters avoid humans, undisturbed shorelines with abundant shrubby vegetation and downed woody debris provide prime denning habitat. They often use old beaver lodges for dens and log jams and crevices in rock piles. Since this mammal eats primarily fish, it requires shoreline habitats that support large, productive fish populations.

Marten and fisher share the same general distribution and habitats. Both require large unbroken tracts of coniferous or mixed forest with abundant large trees for maternal denning sites. Fisher dens are usually in cavities in dead or living trees or fallen logs and these animals appear to prefer trees larger than 40 cm diameter at breast height. Marten often use cavities originally made by woodpeckers.

Exhaustive searches are not recommended, since feeding and denning sites for all these mammals are usually very hard to find. Long-term survival of these species and other carnivores with large ranges is best assured by taking a broad, landscape approach to Natural Heritage System planning by identifying and protecting large natural areas that include the best quality habitat for these species. Protection of sufficient habitat for these area-sensitive species will also help provide suitable habitat for many other species.

How to find

- Although specific sites are hard to find, OMNR biologists and foresters, local naturalists, and residents may know the location of some potential feeding and denning habitats. OMNR staff can also provide contact with trappers who may know the location of prime habitats.
- Use aerial photographs, topographical maps, and FRI maps to locate relatively undisturbed shorelines, wetlands, and closed-canopy forests with larger, older trees that might provide suitable structure.
- Habitat supply models are available through OMNR.

5.4.3 Highly diverse areas

These are areas of high species or vegetation community diversity. If protected within a Natural Heritage System, such sites will contribute greatly to maintenance of overall biodiversity. Although these areas may be found throughout the province, they have certain characteristics that can help to narrow the search for them. Often highly diverse areas contain a wide range of habitats or ecosystems and the large variety of plants and animals associated with them. These areas frequently have species with both northern and southern affinities, and rare species are often found on such sites.

The deciduous forest region of Ontario (the Carolinian zone) has long been recognised as a part of the province with many highly diverse areas. More vulnerable, threatened and endangered species are found here than in any other Canadian life zone. Other parts of southern Ontario with many highly diverse areas include the Frontenac Axis of southeastern Ontario; Grey and Bruce counties; and parts of Frontenac, Lennox-Addington, Lanark, Renfrew, Hastings, and Haliburton counties.

On the Canadian Shield, areas underlain by carbonate bedrock frequently support rich communities because these substrates are less erosion resistant than the acidic granite and gneiss bedrock types, and encourage development of more nutrient-rich, basic soils. In southern Ontario, sites within the contact zone between Paleozoic limestone and the precambrian bedrock of the Canadian shield often support highly diverse communities.

How to find

- Use local expertise, aerial photographs, and maps to look for areas with the following characteristics that frequently result in highly diverse communities:
  - good diversity of vegetation and vertical structure, usually in the form of different vegetation layers
  - good diversity of ecosystems such as wetlands, forests, and old fields
  - biophysical features such as the presence of cliffs; springs or seeps; pockets of deeper, more fertile soils; abundant organic debris on the ground (e.g., large decaying logs)
  - relatively little human disturbance
- Conduct field investigations where necessary to check potentially diverse sites.
- Site district and inventory reports and environmentally significant areas studies often provide descriptions of many sites. This information may provide a start for further investigations.

5.4.4 Cliffs

Cliffs are dominated by bedrock with sharp or variably broken edges and a vertical relief greater than three meters. Average soil depth is usually less than 15 cm and restricted to places where organic debris and mineral material can accumulate such as in cracks, hollows, and along the upper rim.

Many cliffs may be locally significant because of their value as specialised habitat for wildlife such as nesting peregrine falcons or rare plants such as purple-stemmed cliff brake. During summer, large numbers of turkey vultures may roost on secluded cliff faces. Many cliffs have areas where groundwater seepage creates a thin film of water running over the rock surfaces. Often unique floral and insect species are associated with these specialised habitats. Some surfaces contain a diverse assemblage of algae and fungi that live within the crystalline structure of the rock.

Cliffs composed of limestone, dolostone and/or sandstone are most prevalent along the Niagara Escarpment, from Manitoulin Island to near Niagara-on-the-Lake. Granite cliffs are more widespread in the province, but metamorphic/granitic cliffs are only found on the Frontenac axis in Site Region 6E.

How to find

- Use topographical maps to locate areas of sharp relief.

5.4.5 Seeps and springs

Seepage areas, springs, and small intermittent streams provide habitat for numerous uncommon species such as northern two-lined salamander and ginseng. In winter, wild turkey and white-tailed deer also forage in these areas because of the lack of snow on the ground. Often these areas support a high diversity of plant species. Many of the most important seeps are in forested areas where the canopy maintains cool, shaded conditions.

These landscape features are hard to find but, because of their importance to many species, considerable effort should be made to find them, especially sites with several seeps and springs.

How to find

- Use topographical maps and aerial photographs to locate small streams and headwater areas that could indicate the presence of seeps. Headwater areas for coldwater streams are often excellent areas to find seeps and springs. These areas often have rolling topography.
- Use of thermography, location of brook trout redds and reference to local to hydrogeological studies.

6 Identifying Habitats of Species of Conservation Concern

6.1 Definition

Species that can be considered species of conservation concern include:

- species identified as nationally endangered or threatened by the Committee on the Status of Endangered Wildlife in Canada, which are not protected in regulation under Ontario's *Endangered Species Act*
- species identified as provincially vulnerable based on lists of *Vulnerable, Threatened, Endangered, Extirpated, or Extinct Species of Ontario* that are updated periodically by the OMNR (Appendix P)
- species that are listed as rare or historical in Ontario based on records kept by the Natural Heritage Information Centre in Peterborough (S1 is extremely rare, S2 is very rare, S3 is rare to uncommon)
- species whose populations are known to be experiencing substantial declines in Ontario
- species that have a high percentage of their global population in Ontario and are rare or uncommon in the planning area
- species that are rare within the planning area, even though they may not be provincially rare
- species that are subjects of recovery programs (e.g., the Black Duck Joint Venture of the North American Waterfowl Management Plan)
- species considered important to the municipality, based on recommendations from the Conservation Advisory Committee

Habitat for these species is exclusive of those habitats for species covered under the Habitat of Endangered and Threatened Species of the Natural Heritage Component of the Provincial Policy Statement.

6.2 Ecological function/effects of loss

The ecological function of this habitat is to ensure that associated species can maintain long-term, viable populations. Loss or degradation of this habitat may threaten the global existence of some species, and lead to accelerated declines of species already at risk. At the local level, the loss of species will result in loss of biodiversity.

6.3 Identification of habitat of species of conservation concern

Preliminary estimates in 1996 indicate, at the provincial scale, there were at least 105 species of conservation concern (not including species designated vulnerable by OMNR's Committee on the Status of Species at Risk in Ontario). Thirteen Ontario species are nationally endangered; at least 57 species have a high percentage of their global population in Ontario; and 35 species of birds in Ontario are experiencing significant population declines. These numbers are based on long-term data, such as 25 years of breeding bird survey data. Experts are aware of declines in other groups of wildlife, such as amphibians however; they do not have long-term data on these species.

In this guide, the species of conservation concern do not include species that have been designated threatened or endangered by the OMNR. These species are protected under the *Habitat of Endangered and Threatened Species* component of the Natural Heritage section of the *Provincial Policy Statement* and there are methods for determining the significant portions of their habitat. Yet, some of the methods described in this guide may be useful for finding any rare species. Refer to Appendix P for a list of endangered, threatened, rare, vulnerable, or declining wildlife species of Ontario.

Many species of conservation concern are uncommon or rare species that normally do not exhibit high population densities (red-shouldered hawks, lynx). Others have fairly specialised habitat requirements or narrow tolerances for survival that are poorly understood. Other species may be uncommon because their habitat is rare. Because of the sensitive nature of these species, even seemingly minor alterations to their habitats often result in their disappearance. Protection of their habitats in the municipality will help to maintain local populations and contribute to their recovery.

6.3.1 A suggested approach to habitat identification

Although there is often little specific information about the habitat requirements of many species of conservation concern, most of these species can still be protected within a Natural Heritage System. To accomplish this, the planning authority will need to answer the following questions:

What species of conservation concern are likely to occur in the municipality?

Appendix F provides a list of information sources that can be used to identify many habitats of species of conservation concern that are found in the planning area. The OMNR Ecologist will know which endangered, threatened, or rare species listed in Appendix P occur or are likely to occur in the planning area. Bird Studies Canada and the OMNR recently prepared a list of Ontario breeding landbirds with high conservation priority. Appendix G provides lists of plants and animals, describes their distribution, and gives an indication of where they may be found.

Where are these species likely to be found in the municipality?

The information sources listed in Table I-3 in Appendix I may provide locations of some of these species but most will not be located easily. Therefore, it is suggested that the planning authority consider forming a Conservation Advisory Committee (CAC) consisting of experts familiar with the flora and fauna of the municipality (see Section 3.4). Atlas data indicates areas where species of conservation concern may occur.

Many species and habitats of conservation concern will be contained within the other natural heritage features and areas of the Natural Heritage Component of the Provincial Policy Statement (significant woodlands, wetlands, valleylands, ANSIs, fish habitat) as well as the other components of *Significant Wildlife Habitat*. It is common to find several species of conservation concern in close proximity. Therefore, the planning authority should focus its effort on habitats and species of conservation concern that will not be adequately protected through the identification of these other components.

Which of these species should the planning authority protect under this component of *The Natural Heritage Policy*?

The planning authority is urged to protect species of conservation concern and their habitats in the following order of priority:

- globally rare
- nationally rare
- provincially rare
- regionally rare
- locally rare species
- species of concern to the planning authority

Ontario's wildlife species have been ranked for rarity by staff at the Natural Heritage Information Centre (NHIC) in Peterborough. Planning authorities can obtain these lists from the OMNR ecologist or from the NHIC website (Appendix F). In addition, Table Q-3 in Appendix Q provides a list of criteria that the planning authority can use to determine species of conservation concern. This does not include species designated as endangered under the *Endangered Species Act*. Many species (globally rare etc) are not designated.

6.3.2 Summary

The following guidelines summarise the process of identification of species and habitats of conservation concern.

- Contact the OMNR ecologist and Appendices G and P for a list of potential species of conservation concern that are known for the planning area, based on provincial and regional lists. Additional species may be added to this list based on recommendations from the Conservation Advisory Committee.
- Afford the highest priority for protection to habitats of the rarest species regardless of where they are found.
- Next, concentrate protection efforts on species of conservation concern that are most threatened and/or currently unprotected because their habitats are found

outside other natural heritage features. Refer to the habitat matrices (Appendix G) for information regarding the habitat requirements of some of these species.

- Conduct field investigations of sites that may be important to these species, but have not had their conservation importance assessed. See Table Q-3 in Appendix Q for criteria that could be used to evaluate these sites. See Appendix D for information about how to conduct field investigations and Appendix G for the habitat requirements of species.

7 Identifying Animal Movement Corridors

7.1 Definition

Animal movement corridors are elongated, naturally vegetated parts of the landscape used by animals to move from one habitat to another. They exist at different scales and frequently link or border natural areas. Animal movement corridors encompass a wide variety of landscape features including riparian zones and shorelines, wetland buffers, stream and river valleys, woodlands, and anthropogenic features such as hydro and pipeline corridors, abandoned road and rail allowances, and fencerows and windbreaks. The Natural Heritage Component of the Provincial Policy Statement states that *natural connections between natural features should be maintained and improved where possible*.

7.2 Ecological function/effects of loss

Animal movement corridors allow animals to travel freely and safely across the landscape by providing cover, shelter from harsh weather conditions, and by minimising encounters with predators and people. They are especially important to animals that require a variety of habitats to survive.

Animals move for several reasons. Often a particular area does not satisfy all seasonal habitat requirements of a species. For example, some forest salamanders spend the summer and winter in forest soils but, in spring, breed and lay their eggs in ponds, marshes, or temporary pools that may or may not be located in forest. Larvae mature in the aquatic environment, emerge as adults, and then move back to the forest. Large mammals often must travel over large areas for all of their needs.

Other animals move in response to seasonal changes in climate (white-tailed deer, moose, caribou, and migratory birds). Often these animals follow traditional migration routes or corridors. For example, the north shores of Lake Ontario and Lake Erie form an important migratory corridor for land birds flying south during fall migration.

Subadult animals of many species disperse from their place of birth to establish territories of their own. In order for populations to persist, enough individuals must be able to move among suitable habitats to balance local extirpations and ensure genetic diversity.

Corridors often provide permanent dwelling habitat for some plants and animals. For example, a creek connecting two wetlands may support amphibians and reptiles that are also found in the wetlands; or some corridors connecting patches of forest can provide the entire required habitat for smaller forest mammals such as chipmunks and mice.

Adding corridors to a natural heritage conservation system may increase dispersal abilities of many wildlife species and help maximise biological diversity within a given planning area. They are one way to help offset the negative impacts on wildlife of highly fragmented landscapes, and in some situations, may increase habitat and populations of some species. They may also function as buffer zones, by protecting natural areas and their ecological processes from adjacent land-use activities.

Loss of wildlife movement corridors makes species more vulnerable to predation and disturbance. Local populations of some species (e.g. white-footed mice) may even be extirpated when re-colonisation is impossible due to an absence of corridors.

7.3 Identification of animal movement corridors

In many municipalities in southern Ontario, corridors consist of naturally vegetated areas, often forested land, that run through more developed and open landscapes. They connect the remaining natural areas within and beyond the municipality. Other potentially significant corridors include forested river valleys, shrubby riparian vegetation along smaller watercourses such as creeks, and undeveloped lake shorelines. Sparsely vegetated areas can also function as corridors provided they link relatively natural areas. Many wildlife species move freely through agricultural land to reach natural areas.

It is seldom possible to observe wildlife species using corridors. Some species pass through corridors quickly whereas others may reside there for some time. Often animal movement corridors can be determined accurately using maps, aerial photographs, and a sound knowledge of species' habitat requirements. The following guidelines are presented to help identify potentially significant animal movement corridors.

- Identify animal movement corridors only after other natural heritage features, including significant wildlife habitats have been located and mapped.
- Contact OMNR for their suggestions on the locations of corridors and restorable corridors. Knowledgeable local residents may be aware of locations of some corridors, especially for large, visible species.
- Use knowledge of habitat requirements and behaviour of key species to help identify potential corridors for them.
- Use the most recent aerial photographs and maps (topographical, FRI, wetland, ANSI, land use) to help to identify potentially significant corridors. Use them to locate:
    - the largest natural areas within the municipality and adjacent municipalities that should be linked by existing or restorable inter-regional movement corridors. These inter-regional corridors will be visible on aerial photographs and topographical maps as mostly naturally-vegetated links.
    - the largest and oldest forest stands in and adjacent to the planning area. These areas are likely to support high species diversity. Use the FRI maps to

determine the age and composition of the forest stands in the region. Examination of aerial photographs will help to verify the accuracy of FRI maps.

- the largest and most diverse wetlands. Examination of aerial photographs and topographical maps of wetlands will reveal their configurations and spatial relationship to other natural heritage areas, as well as help to indicate important linkages among them.
- relatively steep and undeveloped river valleys and riparian zones along lakes, rivers and streams. Although it is easy to identify these areas by using aerial photographs and topographical maps, an evaluation of at least some of them is recommended. In some of the most densely populated municipalities of southern Ontario, these riparian areas may be the most important remaining animal movement corridors.
- the most probable linkages to and from known significant wildlife habitat such as winter deer yards and amphibian breeding ponds.
- unopened road and rail allowances, and utility corridors that are potential animal movement corridors.
- hedgerows, windbreaks, and old fields that could function as animal movement corridors. Examination of aerial photographs can help to identify these smaller linkages. In densely populated and heavily developed parts of some municipalities, these small corridors may be the only remaining natural areas that allow animal movement from one area to another.

Identifying the most important corridors that provide connectivity across the landscape is challenging because of a lack of specific information concerning animal movements. There is also some uncertainty about the optimum width and mortality risks of corridors. Furthermore, a corridor may be beneficial for some species but detrimental to others. For example, narrow linear corridors may concentrate breeding species. Raccoons, cats, and other predators can quickly decimate these populations. Also, narrow corridors dominated by edge habitat may encourage invasion by weedy generalist plants and opportunistic species of birds and mammals. Despite the difficulty of identifying exact movement corridors for all species, these landscape features are important to the long-term viability of certain wildlife populations.

7.3.1 Recommendations

The following recommendations are based on widely accepted principles of corridor identification and design.

- All potentially significant corridors should allow safe movement of animals and provide safe dwelling habitat for resident wildlife populations. Corridors should protect moving animals from predators and road mortality.

- Emphasis should be on retaining connections among the most significant and similar natural areas at the larger scale (inter-regional) and within the municipality as well as habitats of species most in need of conservation.
- Maintain corridors that provide several benefits. For example, riparian corridors permit animal movement and help to ensure stable soils, necessary inputs of organic matter, and good water quality. Often these corridors are diverse natural areas because of fertile soils, a variety of habitat structure, a dependable source of water, abundant insect and plant foods, and several different microclimates.
- Corridors should be as continuous and unfragmented as possible. However, some gaps in a potential corridor should not preclude it from consideration.
- There should be no barriers to animal movement within designated corridors.
- Wherever possible, select corridors in regions of the landscape with the lowest road density. Roads can be a serious cause of mortality for species such as nesting and migrating turtles, basking snakes, and frogs, as well as mammals and birds that feed near roadsides.
- Generally, corridor habitat should be as similar as possible to the habitat in which the target species lives.
- Incorporate known animal migration routes into corridors.
- Shorter corridors are preferred since the longer the corridor, the greater the likelihood of increased mortality, barriers to movement, and unsuccessful dispersal attempts. Longer corridors may also need to be wider.
- Generally, the widest possible corridors are best for linking patches of a species' habitat that are farther apart than normal juvenile dispersal distances. Wider corridors minimise edge effects. However, for some small animals at least, corridor width may not be as important as corridor presence. Even small fencerow corridors may be beneficial to the movement of small mammals such as chipmunks.
- Corridors surrounded by inhospitable habitat need to be as wide as possible.
- Corridors should have a good diversity of vegetation structure and composition.
- Consider restoring corridors that link important natural areas or wildlife habitats when and where restoration activities such as reforestation, stream rehabilitation, and regulation of land uses are feasible.
- Natural areas that have been historically isolated should not be connected as they are unique and have evolved to their existing condition.

8 Evaluation of Significant Wildlife Habitat

Evaluation is the process of determining if wildlife habitat should be considered significant under the *Natural Heritage Features and Areas Policy* and therefore warrants protection under the *Planning Act*. Specific wildlife habitats are compared to evaluation criteria to determine if they should be considered significant. Appendix Q provides lists of evaluation criteria for significant wildlife habitat. The evaluation process can be used to determine if a habitat meets a minimum standard for significance. The evaluation criteria can also be used to compare one potential significant wildlife habitat to another, if they need to be ranked. This may be necessary where there are several potential sites and the planning authority wants to place the greatest emphasis on the best sites.

The evaluation process is an important step for designating lands for protection. It can also be used to identify sites that merit further study because of their apparent conservation value or to identify suitable candidates for future restoration efforts. Evaluation allows a planning authority to focus its time and resources on sites that are most likely to be significant. The degree of representation of significant natural heritage features and areas within a planning area is a very important element of evaluation. In order to achieve a comprehensive Natural Heritage System, all natural heritage features and areas should be well represented, or at the very least opportunities for restoration should be identified.

Not all identified wildlife habitats will prove to be significant for the purposes of the Natural Heritage Features and Areas Policy. In landscapes that are still very natural, there are more likely to be some habitats that, although they have value for wildlife, will not be considered significant because they are well represented in the planning area. In areas with very little natural cover remaining, it is more likely that a high proportion of the identified habitats will be considered significant.

8.1 Evaluation criteria and guidelines

The evaluation process involves examining a number of criteria that describe key ecological functions of the habitat. Table 8-1 provides a list of criteria for evaluating wildlife habitat. They provide a comprehensive overview of the most common evaluation criteria used by wildlife and conservation biologists. More specific criteria are presented in Appendix Q.

The criteria listed in Table 8-1 have not been weighted, although this can be done as part of a ranking process (see Chapter 9). However, a high emphasis should be placed on representation. It is expected that for many of the wildlife habitats listed in this guide, the application of the criterion *current representation of the wildlife habitat in the planning area* will be sufficient to determine that a specific habitat is at least locally significant. If a particular type of habitat is poorly represented in the planning area, then it is very likely all examples of this habitat should be considered significant. There may not be a need to apply every criterion to a particular habitat if it has already been determined to be significant. Some further examination may be beneficial in situations where there is a desire to determine what aspects might be improved at some point in the future. A planning authority may also consider breaking their planning area into physiographic units for determining representation within the planning area. Some physiographic features are unique, such as the Oak Ridges Moraine or Niagara Escarpment, and representation within that feature may make more sense than representation within the planning area as a whole.

In general, habitat evaluation should not be a costly and time-consuming exercise. It should first concentrate on criteria that can be evaluated using existing information. Some criteria can be applied using aerial photographs and topographic maps. If the habitat is deemed significant using these criteria, it may not be necessary to conduct a field survey. However, there may be situations where fieldwork is necessary.

Extensive searches for hard-to-find habitats, such as snake or bat hibernacula are not recommended, particularly if the species is unlikely to occur in the planning area. In areas where particular species have been recorded, but critical habitats have not been found, some potential sites can be indicated on maps so that future investigations can be focused on these areas.

The difficulty of finding precise locations of the significant wildlife habitats of some species emphasises the value of adopting some of the basic principles of a landscape approach to planning, discussed in Chapter 2. This includes ensuring that there is adequate representation of all habitat types within the planning area. Although this approach cannot guarantee that all critical portions of habitat of a particular species will be adequately protected, there is a greater probability that these important habitats will be protected than if some habitat types are not included in the Natural Heritage System.

Table 8-1. General evaluation criteria for wildlife habitats.

Criteria	**Definition and implications**
Current representation of wildlife habitat, species, or natural features in the planning area	• refers to the existing range of wildlife habitats, natural features, and species in the planning area, with the primary goal of protecting as complete a representation as possible of them • it applies to both rare and common species • normally assessed at the site district level, but could also be done at the local level • representative natural areas, features, landforms, and wildlife habitats are a solid foundation around which a Natural Heritage System can be designed

Abundance	• refers to the number of individual plants or animals of particular species or guild within a given site, community, or habitat. • it is often based on population estimates for a given area • also can refer to the amount of a given habitat feature (food, ground debris, tree cavities) within an area or habitat
Species diversity	• refers to the number of different species present • sometimes it is applied more specifically (referring to only breeding or migratory species) • generally areas of high species diversity are more significant than areas of lower diversity • areas of lower species diversity may be significant (if site is habitat of species of conservation concern, or site is uncommon in the planning area)
Presence of species of conservation concern (e.g. rare, vulnerable, threatened, endangered, declining, uncommon, sensitive, endemic species)	• usually refers to species that are encountered less often than most other species, or whose population is declining • may refer to species that are rare at some larger scale (ecological region, province, global) • such species may be rare in the planning area but common elsewhere, or common in the planning area but rare elsewhere • such species may be more numerous than perceived but due to size, secretive nature, or other factors, are infrequently encountered • some species may be quite numerous but found at few locations • sensitive species are those species that can least tolerate many human activities or that have very specific microhabitat requirements • endemic species are species restricted to a specified region or locality
Ability of the site to meet the known habitat requirements of target species	• refers to the presence of biophysical features and attributes required by target species for survival and long-term maintenance of viable populations • usually wildlife agencies can provide this habitat information for well-studied species
Condition/quality of site	• refers to the general level of disturbance (either natural or human) on the site • determined by comparison with perceived "pristine" sites • condition often determined by assessing such features as the proportion of non-native species on site; level of human use; number of roads, vehicle tracks, amount of refuse • undisturbed or lightly-disturbed areas are usually more significant than disturbed areas • undisturbed areas have additional value as potential areas for research, provision of baseline information
Potential for long-term protection of site/habitat	• refers to the likelihood of enacting restrictions on land uses that will result in protection of identified habitat and associated species for many years • can also refer to habitats where no restrictions are required because habitat is part of an existing protected area or habitats protected by their inaccessibility
Provision of several significant wildlife habitats	• refers to the presence of more than one of the significant wildlife habitats discussed in this guide

Size of habitat/site	• larger habitats/sites are usually more significant because they tend to support more wildlife, including sensitive species, than smaller areas, due to their tendency to have a broader range of habitats and features, larger interior, and better resilience to impacts • small areas may also be significant, especially when they support rare species, or provide several representatives of a particular habitat or natural feature
Shape of habitat/site	• refers to the physical configuration of the habitat/site • round or block-shaped sites contain less edge per unit area than long, narrow sites and may help protect some species from predation, parasitism, and competition from edge species
Location of habitat/site	• location refers to geographical position relative to other habitats, natural areas, corridors; its degree of isolation from other similar habitats; and/or its spatial distribution across the landscape • generally, habitats within or close to other natural areas are more significant than those that are separated or distant from natural areas
Habitat diversity/complexity	• refers to important physical (configuration of site; local topographic, soil, and moisture conditions; presence of water or corridor/linkage) and biological characteristics (presence of certain species; species and community diversity; diversity of layers of vegetation) that can meet wildlife habitat requirements • high habitat diversity/complexity usually indicates a greater probability that the site is of significant value to wildlife
Evidence of use	• refers to signs of current or traditional use of the habitat by the associated species • usually refers to observations of wildlife or signs of presence of wildlife (scats, tracks, feathers, fur, lodges, nests etc.)
Other perceived values	• refers primarily to values of a site to the larger ecosystem in which it is found (maintenance of hydrological and nutrient cycles, erosion control) • also refers to values of a site to humans (scientific and educational studies, aesthetic and recreational values)

8.2 Field investigations

At times, there will be a need for field investigations to collect important habitat information pertaining to some of the evaluation criteria (habitat quality, species richness). More than one visit to a site is not encouraged, unless necessary, such as to obtain seasonal information. If a site is visited during identification, then sufficient information should be collected at that time for evaluation. Appendix D describes the types of information that should be collected during a field investigation.

The following Sections (8.3 to 8.6) discuss important factors to consider when evaluating specific wildlife habitats.

8.3 Evaluation of habitat of seasonal concentrations of animals

Table Q-1 in Appendix Q lists criteria and suggested guidelines for evaluation of seasonal concentrations of animals. The following section describes key factors to consider during the evaluation of seasonal concentrations of animals. It expands on some of the criteria and provides additional detail that is not in the table. In general for determining significance, the greatest emphasis should be placed on the following:

Representation–this can include representation at the large scale, such as habitat for species that are provincially rare, or it can include representation at the local level

Abundance–habitats supporting high numbers of animals relative to other habitats of the same species within the planning area

Rare Species–the presence of rare species (or species of conservation concern) in an animal concentration area, adds to the probability it will be significant

Multiple Benefits–these are habitats that not only provide habitat for a seasonal concentration of animals, but also other significant wildlife habitat as well, such as rare vegetation communities, specialised habitat for wildlife, habitat for species of conservation concern and/or and animal movement corridor.

Not all sites identified as candidates for protection will be significant. In some cases there will be better examples of the same habitat within the planning area. Some habitats may not be sustainable due to serious habitat limitations that were not identified earlier. Some habitats may not meet a minimum standard for habitat quality and sustainability. For example, a winter deer concentration area may have been identified. However, the site may support only a very small number of deer in winter. Although any concentration of deer may be important, the number of deer using the concentration area may be too small to be considered significant in the context of land-use planning.

Habitat evaluation can be difficult. One difficulty is in finding some of the habitats. This has been discussed in Chapters 2 and 4. Another difficulty is determining the degree of significance of some of the criteria for the identified habitats. Examples include knowing the relative importance of a winter deer yard to the local deer population and knowing the relative importance of a colonial bird nesting site to the local population. The planning authority may not have the expertise to be confident in making a decision on these criteria. Many government agencies and non-government organisations have knowledge of many of these species and their habitats. These organisations should be consulted whenever possible. Appendix F provides a list of agencies and their areas of expertise. Appendix G lists information sources for seasonal concentrations of animals. This information will be helpful when using the evaluation criteria.

See Chapter 4 for a detailed description of seasonal concentration areas and their functions.

8.3.1 Winter deer yards

The OMNR is responsible for managing deer in Ontario. Staff responsible for deer management, are aware of most deer winter habitat and should be consulted about the relative importance of deer yards to the planning area.

The significance of a particular deer yard depends on its context in the landscape. In areas where deer populations are high (and there are a number of large deer yards distributed across the landscape), some of the smaller yards may not be considered significant with respect to the application of the *Natural Heritage Features and Areas Policy*. That is not to say those small deer yards do not have value. All winter habitat for deer has value. It simply means that not all areas will be designated as significant wildlife habitat. In areas where deer are not as abundant and wintering deer are found in a limited number of small yards, all of the deer yards may be considered significant.

Deer management goals can also be used to determine significance. In many parts of Ontario, deer provide high numbers of recreational opportunities, both for viewing and for hunting. Revenue generated from these opportunities is not only important to the local economy, but to the province as a whole. This contrasts to some urban areas where too many deer may be considered a hazard on the roads and a nuisance to landowners. These areas are often not open to hunting.

Deer yard quality is determined from field investigations. Deer yard surveys can be used to determine the quality and extent of the conifer cover, the amount of food available and the relative density of the deer population with respect to the carrying capacity of its habitat.

The planning authority must work cooperatively with the Ministry of Natural Resources in setting deer management objectives. If there are numerous complaints about crop depredation or concern about high numbers of deer-motor vehicle accidents, the Ministry can set higher harvest targets to keep numbers down.

8.3.2 Moose late winter habitat

The OMNR is responsible for the management of moose in Ontario. The Ministry conducts aerial moose inventories once every three years for each Wildlife Management Unit having moose populations. The inventories are normally conducted in January and early February. Although the surveys are not conducted specifically in late winter, OMNR staff may be aware of locations of late winter habitats. They should be contacted for information about the relative importance of any late winter moose habitat.

If moose are common in the planning area, the planning authority should be aware there might be late winter moose habitat that has not been identified. This may be of greatest concern when associated with the shorelines of lakes where there may be potential for conflict with cottage development.

It is recommended that the planning authority contact the OMNR to find out the location and importance of any known late winter moose habitat on Crown land within their jurisdiction, particularly those areas of Crown land that are closely associated with private land where there could be potential conflict.

8.3.3 Colonial bird nesting sites

Agencies such as OMNR, Canadian Wildlife Service, and Bird Studies Canada have information on colonial nesting species. Staff at these agencies can be consulted as well as reference texts such as the *Atlas of the Breeding Birds of Ontario* to determine the relative importance of colonial nesting species in a particular planning area. Nesting colonies that are poorly represented should be considered most significant.

Nesting colonies that support rare species and species that are highly sensitive to disturbance should be considered significant. Higher priority should be given to rarity at the larger scale, such provincial rarity, than rarity at the local level.

Often when evaluating and ranking more than one colony, the number of nests in the colony is one important criterion used to compare colonies. This criterion should also consider whether the colony is expanding or declining. A new colony that is expanding may have a greater chance of long-term sustainability, than a colony that is declining.

Historical use of a colonial nesting site can be an important criterion. Colonies with a long history of use are highly significant. The evaluator should also consider new and expanding populations. Some populations may be recovering due to improvements in water quality or habitat. Colonies for some of these species may not have a long history of use, but they are still very important.

In some cases, potential habitats may also be considered for protection, particularly for species with expanding populations or for species that are forced to move periodically (such as herons where the nesting trees fall down).

Some colonial nesting species can be considered a nuisance when their populations get too high. Examples are ring-billed gulls and double-crested cormorants. These birds and their nesting habitats are protected under the *Migratory Birds Convention Act*. The planning authority must decide if the colonies in their jurisdiction require additional protection through the *Planning Act*.

8.3.4 Waterfowl stopover and staging areas

Generally, the most significant areas support the greatest number of birds and/or species in the planning area. The best areas tend to be very large wetlands. These are often associated with lakes, but that is not always the situation. The best wetlands generally have a diversity of vegetation communities interspersed with open water. Many of the marshes along the Great Lake shorelines are particularly valuable as waterfowl migration stopover habitat because they have an excellent mix of deep open water and shallow marsh habitat.

The Canadian Wildlife Service (CWS) is the lead agency for waterfowl management in Canada. They routinely conduct migration surveys in late fall and early winter. CWS staff are knowledgeable of most of the major migration stopover sites. OMNR conservation officers check waterfowl hunters in the fall and are often aware of locally significant staging habitat. These staff may also know if some uncommon species frequently use certain wetlands. OMNR staff is frequently involved in waterfowl management projects, such as projects associated with the Eastern Habitat Joint Venture. OMNR wetland evaluations include the degree of use of the wetland by migrating waterfowl. Staff at these agencies should be contacted for advice on the relative importance of waterfowl migration stopover and staging habitat.

The amount and distribution of staging areas within the planning area may determine the significance of some locally important staging areas. Some planning areas will have very few large wetlands with open water that can be used by staging waterfowl. All of these wetlands may be very important. Other planning areas may have several locally important staging habitats and the planning authority may want to use the criteria in Appendix Q to determine which areas are best.

Appendix G, the wildlife habitat matrices, lists the habitat requirements of migrating waterfowl. Knowledge of waterfowl staging habitat requirements is important when determining which sites are most significant.

The permanency of wetlands should be considered. Some wetlands, such as new beaver floods, may be temporary. Some of these ponds may be very attractive to locally staging waterfowl for a few years, but when beaver leave the pond they may no longer support staging waterfowl. The highest significance should be placed on permanent wetlands and wetlands that have provided habitat for staging waterfowl for many years.

8.3.5 Waterfowl nesting habitat

Marshes and swamps have greater value to nesting waterfowl than bogs and fens because they are more productive and have more permanent open water. However, bogs and fens are important to certain waterfowl species, and should not be ignored as potential significant waterfowl nesting habitat. Large wetlands and clusters of small wetlands located close to one another usually support greater waterfowl production than single small wetlands.

A number of agencies such as the OMNR, Canadian Wildlife Service, and Ducks Unlimited are very actively involved in waterfowl management in Ontario. Some of these agencies routinely conduct brood surveys in late spring and early summer. OMNR has completed about 2000 wetland evaluations in southern Ontario. Each of these evaluations provides an estimate of the relative value of the wetland for waterfowl nesting. These agencies should be contacted for advice on the relative importance of waterfowl nesting habitat in the planning area.

In 1996, a group of waterfowl experts assembled to develop criteria for determining the significance of waterfowl breeding habitat. Their report is included as Appendix K.

In general, the most significant sites will consistently support large concentrations of nesting waterfowl, species of conservation concern, or a variety of species. All known nesting habitat for ruddy duck, gadwall, northern pintail, green-winged teal, American wigeon, and northern shoveler should be given high priority for protection. These species are uncommon nesters in Ontario. Black duck populations have declined in many parts of North America, in large part due to hybridisation with mallards. In southern Ontario, wetlands supporting black duck nesting should be considered significant. Due to the decline of waterfowl, populations in North America, Canada and the U.S.A. signed the *North American Waterfowl Management Plan*. Considering the continental objectives for waterfowl, sites with high concentrations of more common nesting species, such as mallards and blue-winged teal, should also be considered significant.

A good distribution of nesting habitat should be protected across the planning area. In parts of the planning area where no large highly diverse wetlands remain, some smaller wetlands should be considered significant because they add to the diversity of the planning area.

8.3.6 Shorebird migratory stopover sites

There are a number of sources that can be consulted for information on shorebird stopover habitat (see Appendices A and F). Agencies that have knowledge of important shorebird stopover habitat include OMNR, Canadian Wildlife Service, Bird Studies Canada, and The Federation of Ontario Naturalists. Staff with these agencies and other information sources should be consulted to determine the relative importance of shorebird habitat in the planning area.

The Great Lakes shorelines provide some of the best habitat for migrating shorebirds. Many of these sites have been used for many years and should be considered significant.

High quality shorebird stopover habitat is often in short supply. If a site is lost, birds have no alternate habitats to use or may be forced to use inferior sites which results in increased mortality and subsequent population declines.

Most significant shorebird stopover habitats have a long history of use. Many local birdwatchers will be knowledgeable of these areas.

If there is little information about shorebird stopover sites for a planning area, an examination of aerial photographs and topographic maps will be helpful in determining the relative importance of a site.

Natural, permanent sites are generally more significant than artificial sites such as sewage lagoons or temporarily flooded or exposed areas such as mudflats. An exception would be where natural sites do not exist in the planning area and the only sites available are artificial.

The level of threat to a site should also be considered during evaluation. This is particularly important when considering the Lake Ontario and Lake Erie shorelines. Large portions of these shorelines have been developed, especially near large urban areas. Those sites that remain are extremely important and should be considered significant.

8.3.7 Landbird migratory stopover areas

There are a number of information sources on migrating landbirds (see Appendix F). There are also a number of agencies involved in the protection and management of landbirds. These include Canadian Wildlife Service, Bird Studies Canada, Federation of Ontario Naturalists, and the Ontario Ministry of Natural Resources. The sources and staff from these agencies should be consulted for information on the relative importance of stopover sites in a planning area.

Many significant landbird stopover sites are located within 2 to 10 km of Great Lake shorelines because migrating birds follow these shorelines moving to narrow crossing points to continue their migration. The Niagara Escarpment forms a natural corridor for migrating birds from Niagara Falls to the Bruce Peninsula and onto Manitoulin Island and northern Ontario. Sites with a high diversity of habitat types are best.

Sites that consistently support high numbers of birds, as well as a high diversity of species, including rare species, should be considered significant. Many of these sites will have a long history of use. This type of information can be obtained from local birdwatchers.

8.3.8 Raptor wintering areas

Many raptor wintering areas are used year after year. Few agencies actually monitor these habitats and they will have little information on the relative importance of a particular site. It is important to ensure there is good representation of this habitat in the planning area. Often local naturalists will be aware of sites that consistently attract raptors. Site visits in winter may be necessary to confirm that an area is used by wintering raptors. If a Christmas bird count is conducted in the area, the coordinator of the count should be contacted to find out where raptor concentrations occur.

Raptors frequently hunt over large areas and, as winter progresses, prey populations decline. Therefore, it is important to protect sites that are large enough to support wintering raptors for the entire winter. The best sites should be at least 25 to 30 ha in size.

Sites that consistently support large numbers of birds should be considered significant. The presence of large numbers of birds throughout the winter is a good indication that there are abundant prey populations and there is the right mix of food and cover.

The landuse of a site should be noted. Sites that are most likely to remain unchanged for several years are preferred. Cattle pastures often remain unchanged for many years, whereas hay fields can be cultivated and different crops planted that make the site unsuitable. Sites that are least disturbed are preferred and sites that are part of a rural landscape are preferred to those surrounded by urban development.

8.3.9 Wild turkey wintering areas

The OMNR has responsibility for wild turkey management in Ontario. Staff from the OMNR should be contacted for advice on the relative importance of wild turkey winter roosting habitats to the local planning area. Sites that consistently support large numbers of birds are most significant.

The amount of potential roosting cover is an important consideration when determining significance. In some parts of a planning area, conifer cover may be in short supply. It is common in these situations for the birds to move a considerable distance from their daily feeding area to their nighttime roosting cover. These roosting sites are very important and should be protected. Areas of potential roosting cover can be identified on aerial photographs and these can be compared to the distribution maps from the local OMNR.

At times, turkeys will roost close to houses and people. These birds are susceptible to disturbance. Activities such as snowmobiling and free-running dogs can prevent turkeys from using a suitable area. Greatest significance should be assigned to the least disturbed sites.

8.3.10 Turkey vulture summer roosting areas

These habitats are not easy to identify. Large numbers of birds may not observed using a roosting site every day. Often birds can be observed in the daytime soaring in search of food. They range over broad areas, often returning to their roosts at night. Any sites where roosting birds have been reported should be checked to note the characteristics of the site. Suitable known sites will likely be poorly represented in the planning area and should be considered significant. Sites that consistently support the largest numbers of roosting birds and are exposed to the least amount of disturbance are most significant.

8.3.11 Reptile hibernacula

All sites of locally rare or uncommon species should be considered significant. There should also be representation of sites for more common species, such as the garter snake. This species uses habitats with a good mix of open grassy habitat mixed with forest stands. This type of habitat is also used by many other species.

The most common situation will be where certain species are known to exist in the planning area, but hibernacula have not been located. These species are very important to the biological diversity of a planning area. Areas of suitable habitat for these species should be identified and representative examples should be protected. Areas of suitable habitat can be identified by referring to Appendix G and reference texts. Areas with the greatest potential for having hibernacula should be identified and subsequent investigations can focus on these areas.

The criteria listed in Appendix Q (Table Q-1) can be used to evaluate reptile hibernacula. Areas of suitable habitat should be examined using different criteria. For example, the highest significance should be assigned to:

- sites that are known to have populations of snake or turtle species that concentrate in winter
- the largest areas containing suitable habitat. These are most likely to contain critical features such as hibernacula.
- sites containing the greatest diversity of habitat types
- the least disturbed areas, as they have the greatest probability of maintaining snake or turtle populations. Many snakes and turtles are killed on roads, especially in spring and fall when they are attracted to warm asphalt or are moving to nesting areas. Also, many people do not like snakes and will destroy them.

8.3.12 Bat hibernacula

All known sites should be considered significant. Potential habitats can be identified from geological maps and from the Ministry of Northern Development and Mines. Individuals who explore caves recreationally are known as spelunkers. They commonly map caves and note their characteristics. Information about the size of the cave opening, depth of the cave, presence of water in the cave, winter air temperature and humidity, and evidence of any bat use would be helpful in determining the potential of the cave to supply winter hibernation habitat. Potential sites should be investigated by someone knowledgeable of bats who would know where to look and what species they might encounter. Bats should not be disturbed in winter and that is another reason why someone with expertise should conduct any investigations. University researchers may know of potential habitats that can be investigated.

Appendix Q (Table Q-1) lists criteria for evaluating identified bat hibernacula. Potential habitats such as caves, if they are found in the planning area, should be considered significant. These habitats are uncommon in Ontario and they provide a unique habitat, not only for bats, but other species as well.

8.3.13 Bullfrog concentration areas

The OMNR has responsibility for managing bullfrog populations in Ontario. They have knowledge of local populations and distribution of the species. Staff at the OMNR should be consulted for advice on the relative importance of bullfrog concentration areas in the planning area.

The planning authority should ensure there is good representation of this habitat in the planning area. The criteria listed in Appendix Q (Table Q-1) can be used to evaluate bullfrog concentration habitats.

Greatest significance should be assigned to sites that consistently support the highest number of bullfrogs. Bullfrogs are very vocal and easy to observe. Surveys should be conducted in mid-May to late June, when they are concentrated and males are in full chorus. Field investigations should include information on the relative abundance of bullfrogs; a description of the habitat, including size, vegetation species and shoreline cover; adjacent land uses and any other potential concerns, such as water-level fluctuations.

In areas where bullfrogs have declined and there is potential for population recovery, even small concentrations of bullfrogs may be considered significant. This is especially the case in planning areas where there is poor representation of bullfrogs and bullfrog habitat. Sites supporting low densities of bullfrogs may be significant if they are near the limits of the species' range.

8.3.14 Migratory butterfly stopover areas

Agencies such as Agriculture Canada (Ottawa) and the Federation of Ontario Naturalists monitor some populations of butterflies and have a particular interest in monarch butterflies. Also individuals devote considerable time tracking monarch butterflies each fall and spring. Staff at the above agencies, as well as Ontario Parks staff at provincial parks along the shorelines of lakes Erie, Ontario and Huron can be consulted for advice on the relative importance of identified butterfly stopover areas. They may be able to offer advice on the historical use of sites and on the relative numbers of butterflies using sites.

The criteria listed in Appendix Q (Table Q-1) can be used to evaluate identified butterfly stopover habitats. Large sites are usually most significant because they contain the greatest diversity of plant species.

8.4 Evaluation of rare vegetation communities

All provincially rare vegetation communities (S1 to S3 ranking) as described by Bakowsky (1996) in the planning area should be considered significant. The precise locations of many of them are known and the planning authority should contact the OMNR ecologist for more specific information. See Appendix J for a list of the provincially rare vegetation communities and Appendix M for of some of their locations.

Table Q-2 in Appendix Q lists criteria that could used to evaluate potentially rare vegetation communities. One of the most important criteria is current representation of the community in the planning area based on its area relative to the total landscape or the number of examples of it within the planning area.

Geomatics International Inc. (1991) used the criterion of five or fewer documented locations of a community type within Halton Region to define remnant habitat. Brownell and Larson (1995) prepared a preliminary list of regionally rare communities found in the Region of Ottawa-Carleton based on the area of each community; each of these communities represented less than one percent of the remaining natural area of the municipality. In addition, the OMNR has recommended that any forest cover type comprising less than five percent of the forest group to which it belongs (deciduous, coniferous, mixed) should be considered uncommon and significant. The Nature Conservancy in the United States considers vegetation communities rare if they represent less than three percent of the remaining natural area in the planning area and/or are found in five or fewer locations.

In addition to the criteria of rarity and representation, other criteria such as the rate of loss or degradation of a specific community and its value to wildlife might also be used to evaluate its level of significance. For example, in many areas, riparian areas that not only support rare vegetation communities, but often other significant wildlife habitats, are disappearing because of shoreline development along some lakes and rivers. Early successional fields that support rare vegetation communities and provide important nesting habitat for several species of birds are being lost to development or natural succession. Recognition of these important sites, followed by their protection, will safeguard many species.

Key information to know

- significant sites identified by local naturalists, Federation of Ontario Naturalists, Agriculture Canada (Ottawa)
- current representation of the rare community in the planning area
- presence of species of conservation concern
- presence of other significant wildlife habitats
- level of disturbance in the community (least disturbed sites often are of higher quality and contain more species of conservation concern)
- age of woodland (mature woodlots often contain more species of conservation concern than younger woodlots)
- level of threat to community

Additional information

- size of the site and amount and distribution of suitable habitat
- quality of the vegetation community (level of disturbance from human activities such as off-road vehicle use; number of non-native, invasive plant species; agriculture, cattle grazing)
- species diversity and abundance

8.5 Evaluation of specialised habitats for wildlife

Many species have special habitat requirements. Some species have specific requirements for the size of the habitat patch they need. For others, the critical element is the amount of total suitable habitat in the general area that is required to make it suitable for them. Specialised habitats can also refer to special habitat structure, such as cavities for nesting or rotting logs that provide a source of food. It can also refer to unique habitats that provide specialised conditions, such as springs and seepage areas.

Evaluation of some of these habitats is difficult. Many may not have been identified and, in some cases, the planning authority may have to choose the most significant habitats from a number of potential habitats that have been identified in Chapter 5. Table Q-2 in Appendix Q lists criteria that can be used to evaluate specialised habitats. The criteria in Table Q-2 are not prioritised, although it is suggested that the "current representation in the planning area" is probably the most important criterion. The planning authority may choose to prioritise the criteria in Table Q-2 according to needs and priorities for their planning area.

It should be noted that there is overlap between some specialised habitats. For example, old growth or mature forests may also contain interior habitat for area-sensitive species, areas of high diversity, and seeps and springs. Each of the habitat types is discussed and evaluation criteria provided in Table Q-2 because they are not necessarily found in the same sites and it is important to understand the diversity of ecological functions that a site may possess. Chapter 5 summarises the ecological characteristics of specialised habitats for wildlife.

8.5.1 Sites supporting area-sensitive species

Generally the planning authority can best protect local populations by protecting the largest, unfragmented forests, the largest grasslands (which may include unimproved pasture or early succession fields) and the largest wetlands. In some planning areas, the largest sites that remain may not meet the area requirements of all the area-sensitive species that could potentially use this type of habitat. However, it is still important to protect the best of what remains. These habitats will be used by some species and by protecting them, there may be opportunities to improve these habitats.

The planning authority should have an idea of the structure and composition of the habitat. This can be determined from aerial photograph interpretation and FRI maps for forest stands. Natural forest stands containing a diversity of forest tree species and structure would be more significant than the same sized forest stand composed of a single species.

A number of agencies are actively involved in the monitoring and protection of area-sensitive species especially birds. These include the Canadian Wildlife Service, Ontario Ministry of Natural Resources, Bird Studies Canada, and the Federation of Ontario Naturalists. The information sources listed in Appendix F and the staff at the above agencies should be contacted for advice on the relative importance of habitats, both in the context of the planning area and the greater landscape.

Habitat shape is also an important consideration when determining the significance of a potential habitat. Habitat shapes that maximise the amount of interior habitat, such as circular or square shapes are best.

Some species require larger blocks of habitat than others (see Appendices C and G). Greatest significance should be assigned to those habitats that support species with the largest habitat requirements or that support species of conservation concern (Section 8.6).

Minimum habitat thresholds apply to species that require a minimum amount of suitable habitat within the general landscape before they will use that habitat, although their territorial requirements may be much smaller. In order to address minimum habitat thresholds, a landscape approach must be applied. A specific amount of habitat must be protected. This has been addressed somewhat by the recommendations in this guide to maintain good representation of all habitat types in the planning area.

8.5.2 Forest stands providing a diversity of habitats

The most significant stands contain a diversity of features, such as tree cavities, fallen logs, abundant forest structure (in terms of topography as well as species composition and age structure of the forest stand), soil moisture conditions, and food plants for wildlife. Table Q-2 in Appendix Q lists criteria that can be used to evaluate forest stands that provide a diversity of habitats. Following are some general considerations:

- Large, older, undisturbed forest stands provide the most significant habitat. The size of stands can be determined from aerial photographs, topographic maps, and satellite imagery maps. Stand ages and composition can be obtained FRI maps.

- OMNR and conservation authority staff may be knowledgeable of the forest stands in the planning area and may be contacted for advice on the relative importance of stands. It should be stressed that this significance determination is based on the stand's diversity of wildlife habitats and not necessarily on its timber production value. OMNR staff may also be aware of the management history of the stand.

- Stands containing species of conservation concern and a large number of cavity-dependent species (see Appendix G) should be considered significant.

- Stands that contain other specialised habitats for wildlife should also be considered significant. Examples include the presence of candidate old growth stands and the presence of springs and seepage areas. Stands with a variety of vegetation communities of different age classes will support a high diversity of wildlife species.

8.5.3 Old growth or mature forest stands

Since true old growth forest stands in southern Ontario are very rare, the maturest stands in the planning area should be considered most significant. The best stands are those that exhibit the greatest number of old growth characteristics. These stands can be identified by consulting OMNR forestry staff and using FRI maps. Candidate sites should be checked in the field and characteristics of the stand noted. OMNR staff may be able to provide information on management history.

Greatest significance should be placed on the least disturbed forest stands. The closed canopy and moist growing conditions allow some very sensitive species to grow and these are vulnerable to trampling.

Stands that provide habitat for species of conservation concern should be considered significant.

8.5.4 Seeps and springs

Agencies such as the OMNR, conservation authorities and the Ontario Ministry of Environment (OMOE) may be aware of areas with seeps and springs, particularly those associated with the headwaters of cold water streams and wetlands. No specific ranking system exists for these features. However, staff with these agencies may be contacted for advice about the relative importance of seeps and springs and their value for maintaining cold water habitat for fish. This is also an important consideration.

Planning authorities should ensure they protect a good representation of this type of habitat.

Seeps and springs that are part of a forest or some other natural vegetation community should be assigned greater significance than those that are isolated or in disturbed habitats. Those that are important to other natural heritage resources, such as fish habitat, should be considered significant.

It may be necessary to conduct field investigations of identified seeps and springs. Wildlife species at these sites can be recorded as well as the characteristics. Appendix G provides a list of wildlife species known to use seeps and springs. The permanency of these features can be determined by checking them in the summer. Some dry up in summer and others maintain a moist environment throughout the year. Greatest significance should be assigned to sites that support species of conservation concern and to sites that provide year-round moist conditions.

8.5.5 Woodlands supporting amphibian breeding ponds

It is unlikely the planning authority will find an expert to provide advice about which woodland ponds are most significant. There may be naturalists in your area that are knowledgeable about amphibians. These people should be contacted for information on species occurrence and abundance. The primary consideration is to ensure there is good representation of this type of habitat in the planning area. Generally, the most significant sites will be associated with large woodlands associated with some type of riparian habitat.

It may be necessary to conduct field investigations in spring, when species using the ponds can be identified. The characteristics of the ponds should also be recorded. This would include such information as a description of the forest stand in which the pond is located (species, size, abundance of rotting logs on the forest floor, etc.), diversity of vegetation in the pond, shoreline vegetation, water quality, and degree of disturbance. The permanency of ponds may also be a consideration. The greatest significance would be assigned to ponds that support a high diversity of species, species of conservation concern, and high numbers of amphibians.

8.5.6 Special woodland feeding habitat

Most special woodland feeding habitats will not be identified and ranked. OMNR forestry staff may be aware of some particularly valuable stands and may be consulted. Some stands may be identified on FRI maps. The planning authority should ensure there is good representation of this type of habitat in the planning area. Large forest stands containing a diversity of mast producing trees would generally be most significant.

Any forest stands that are used consistently year after year should be assigned a higher level of significance. In many cases, this will not be known. The exception is some areas of black bear range, where evidence of bear use, especially in stands of beech trees, is obvious.

It may be necessary to investigate some sites in the field. Field investigations should collect information of the species and age of the trees (vigorous, full-crowned trees are the best producers). Field investigators should also record any signs of use by wildlife.

8.5.7 Osprey nesting habitat

Ospreys may be considered a species of conservation concern (see Sections 6.0 and 8.7). Ospreys are often considered an indicator of good water quality. It is recommended that all known Osprey nests be considered significant.

Nesting records that are not recent should be verified in the field. Sometimes nest trees fall down and the birds use another site close by. It is common for new nesting pairs to nest in the same general area.

In areas where Osprey populations are expanding, some potential habitat should be identified and protected. Sites with the greatest potential are undisturbed shorelines, with large trees close to productive shallow water feeding areas.

8.5.8 Turtle nesting habitat

Few turtle nesting sites have been identified. It is common to see turtles along roadsides attempting to lay eggs in the gravel shoulders of the roads. Obviously, these are not preferred sites. There is considerable risk to females and young as they cross roads. Turtle eggs suffer high mortality due to predation by raccoon and skunk. In some areas, virtually all eggs are lost each year. This problem becomes worse as turtles are forced to concentrate in fewer and fewer sites. Greatest significance should be assigned to sites that are natural, least disturbed and are closest to their habitat. The most significant sites should have safe movement corridors between the nesting and aquatic habitat.

The most significant sites will be those that are used by species of conservation concern and that consistently support the most nesting turtles. To ensure good representation of turtle nesting habitat, some potential habitats should be protected, even if it is not known to what extent they are used.

8.5.9 Special moose habitats–aquatic feeding areas, calving sites and mineral licks

Table Q-2 in Appendix Q lists criteria that can be used to evaluate moose aquatic feeding areas.

The OMNR may be aware of some of these special habitats, especially moose aquatic feeding habitats. They should be consulted for advice on the relative importance of any of these identified special habitats to the planning area. Very few calving sites and mineral licks have been identified. Therefore, any identified sites should be considered significant. The least disturbed aquatic habitats are most significant.

Movement corridors to these special habitats should be identified and protected. Moose are strongly attracted to aquatic feeding areas and mineral licks. New roads constructed near these sites may result in increased mortality to moose and a high risk to people.

Habitat adjacent to any special moose habitats should be identified and described. For example, the loss of the conifer resting cover adjacent to an aquatic feeding area may make it useless for moose.

8.5.10 Mink and otter feeding/denning sites; marten and fisher denning sites

Few of these specialised habitats have been identified. First, it is necessary to know which species occur in the planning area. Then, the planning authority should ensure it identifies and protects a good representation of suitable habitat for those species. This is an example of where a landscape approach to planning would be best. If these species are present in the planning area and large blocks of suitable habitat are represented in the Natural Heritage System, there is a good probability these species will continue to survive.

Natural shoreline habitat should be protected for mink and otter. High quality aquatic habitats are required that produce an abundance of fish, crustaceans and insects. Natural, undisturbed habitats are best.

Large, unfragmented blocks of forest are preferred by marten and fisher. Many of these forest stands will have a number of other values as well, such as interior forest habitat.

Sites that are the most natural and have the least amount of disturbance are the most significant.

8.5.11 Areas of high diversity

Often the most highly diverse sites contain several different vegetation communities and numerous microhabitats. Large, natural sites have a greater likelihood of having more diversity, although this is not always the case. Disturbed sites often have less vegetative structure, sensitive species are frequently missing, and non-native species can reduce the diversity of natural species.

A higher level of significance should be assigned to sites that contain rare species or vegetation communities.

Some potential sites may have been identified from existing reports or from input from local naturalists. It may be necessary to conduct field investigations to verify and update information. This information can be used when applying the evaluation criteria listed in Table Q-2 in Appendix Q. During field investigations information should be collected on species occurrence, vegetation community identification, soils and topography.

8.5.12 Cliffs and caves

Many planning areas do not have cliff or cave habitat. In areas where cliffs have been identified, the planning authority should ensure there is good representation of this habitat.

Greatest significance should be assigned to cliffs that provide habitat for rare species or rare vegetation communities. It may be necessary to conduct field investigations to verify or update information. Information should be recorded on species occurrence and vegetation communities. Physical characteristics of the cliff should also be recorded. This would include height, bedrock type, surrounding landuse, potential for human disturbance, etc. Cliffs that support other significant habitats or functions should be considered significant. Examples include nesting habitat for birds, roosts for turkey vultures, or talus slopes.

Any caves that provide winter habitat for bats should be considered significant. These habitats are rare and any sites are very important.

8.6 Evaluation of habitat of species of conservation concern

Section 6.1 defines species of conservation concern and Section 6.3 describes what species should be considered and an approach that could be used to identify their habitats.

Refer to Table Q-3 in Appendix Q for criteria and guidelines for the evaluation of these habitats, and Appendix G for critical habitat requirements of many of these species.

Many habitats for these species will be under-represented within the planning area and therefore should be considered significant. Habitats that support large populations of a species of concern should be considered significant.

Key information to know

- current representation of habitat/species in the planning area
- critical habitat requirements
- member of a species group/guild
- location of habitat (in seasonal concentration area or rare or specialised habitat)
- size of population

Additional information

- sensitivity of species to specific environmental conditions, disturbance
- habitat quality

8.7 Evaluation of animal movement corridors

In general, the evaluation of the significance of animal movement corridors is based on an assessment of physical characteristics of a corridor:

- length
- width
- continuity
- habitat structure and type of corridor
- condition of corridor
- distance between the natural areas that the corridor connects
- actual or potential use of the corridor by wildlife
- whether the corridor meets the basic needs of the target species or group of species that reputedly use it

Several criteria and guidelines that can be used to evaluate animal movement corridors are outlined in Table Q-4 in Appendix Q.

Intuition and/or professional judgement, is often required to evaluate animal movement corridors because knowledge about their actual effectiveness and use by wildlife is limited. Also, animal movements may occur quickly, often under certain weather conditions, or at night. However, sometimes their importance can be accurately inferred from existing information. For example, if a rare species of salamander is known to occur in a forested area and there is only one pond near the forest where females can lay their eggs, it is a safe assumption that salamanders use the corridor between the pond and the forested area.

Animal movement corridors must be evaluated within the context of the local landscape; therefore, the local characteristics of the landscape must be considered. In municipalities with little remaining forest cover, relatively narrow and somewhat fragmented hedgerows or small streams with some riparian vegetation may be considered significant. In natural regions, significant animal movement corridors should be of higher quality and provide wider, unfragmented links to important natural areas.

Significant corridors will usually be wider (the wider it is, the fewer edge effects will occur), without roads (to provide safer movement), and structurally and compositionally diverse. Often they will be part of a known wildlife migratory route (deer movement from their winter yard to summer range). Sometimes, significant corridors will link two or more important natural areas within or outside the planning area. In densely populated parts of Ontario, significant corridors may be among the few remaining natural areas. Fence and hedgerows should not be considered significant unless they provide the only animal movement corridors in the planning area.

Key information to know

- location of important natural areas (forest, undisturbed grassland patches, wetlands)
- location of remnant and disjunct habitats
- location of seasonal concentration habitats and presumed home range habitat for target species
- relative location of roads and potential corridors
- list of species that are dependent on corridors (see wildlife habitat matrices in Appendix G)
- possible hazards facing wildlife moving in potential corridors
- provision of other important wildlife habitats
- presence of species of conservation concern

Additional information

- description of important corridor characteristics (vegetation structure and composition, approximate width and length, presence of roads across or in corridor, degree of fragmentation and size of gaps in the corridor)
- description of adjacent land uses
- level of human disturbance in and adjacent to the potential corridor
- evidence of use by wildlife
- diversity and abundance of species using the corridor

9 Ranking Significant Wildlife Habitat

Ranking habitats is only necessary when several examples of the same type of habitat have been identified and there is a need to assign relative levels of conservation significance to them. Those receiving the highest ranking represent the best examples of the habitat in the planning area and probably address significant wildlife habitat at several levels. Often these habitats will have conservation significance at the larger regional scale.

In many cases, ranking will be unnecessary. For example, all poorly or under-represented habitats, habitats of provincially or regionally rare species of conservation concern, and habitats of obvious importance to many wildlife species might automatically be considered highly significant.

9.1 An evaluation of three ranking methods

Three commonly-used comparative evaluation methods that could be used to rank significant wildlife habitats are described and compared below, based on a review of multiple criteria evaluation systems by Smith and Theberge (1987).

1. Minimum standards

The minimum standards evaluation method is useful when criteria are measured on different scales and when different criteria are not comparable, as is the case in evaluating numerous natural areas for several ecological criteria. This method ranks candidate sites based on whether they meet an acceptable minimum standard for at least a few criterion. Therefore, if the minimum standard for species diversity is 20 percent more recorded species than the average for all candidate sites, then all of the candidate sites in Table 9.1 might be considered "significant", as indicated by the "√". The minimum standards evaluation method does not overlook sites that are outstanding in one criterion as compared to another evaluation method called additive weighting, where the summed score for candidate sites that have "average" scores for all criteria may be higher.

Table 9-1. Minimum standards evaluation method example.

Candidate Site	Diversity	Rarity	Productivity
Site A	√	√	√
Site B	√		
Site C	√	√	

The minimum standards evaluation method is more ecologically and mathematically valid than the other two evaluation methods discussed in this section. For many reasons, the aggregation of criteria measurements into one index (as with the additive weighting and ranking evaluation methods) obscures the complexity of the evaluation process. Aggregating criteria ignores relationships among ecological criteria. Also, not all criteria are applicable to every kind of natural area. For example, rarity may be more applicable to smaller areas while diversity may be more applicable to larger areas.

Evaluators will also find that the minimum standards method is the simplest to explain to non-specialists in government, industry, and the public. Using the minimum standards evaluation method will enhance understanding of why a natural area has been determined significant. For example, a particular woodland may be significant because it meets the minimum size criterion and it is believed that larger woodlands support area-sensitive bird species, are less sensitive to invasion by exotic species, and more likely to have associated woodland ecosystem functions and processes intact.

2. Additive weighting

Using the additive weighting evaluation method, candidate sites are scored for several criteria. The criteria may also be weighted in some manner to reflect their relative importance. Scores for each criterion are first multiplied by the weighting for that criterion and then summed for all the criteria to obtain an overall index for each candidate site. This index is used to determine the comparative value of two or more candidate sites.

Scores must therefore be numerical and comparable among criteria. Criteria must be measured using an interval or ratio scale and in comparable units so that a drop in one criterion can be offset by an increase in another. For example, the two hypothetical candidate sites in Table 9.2 have equivalent ecological value.

Table 9-2. Additive weighting evaluation method example.

Candidate Site	Rarity Value	Productivity Value	Recreation Value	Sum
Site A	0	3	0	3
Site B	0	3	0	3
Site C	1	1	1	3

Although this evaluation system is simple, it makes a number of false assumptions. For example, it assumes that criteria are independent of each other when in fact ecological data are highly correlated (e.g., size is positively correlated with diversity [Domon and Bergeron 1987]). The criteria must also be weighted using some reasonable basis for determining the relative importance of each criterion. Weights are often subjective and vary widely. The additive weighting evaluation method may result in the identification of average sites as significant while sites that are outstanding in one criterion are classified as not significant.

3. Ranking

The ranking evaluation method is similar to additive weighting except that each candidate site is ranked for each criterion. For example, three candidate sites may be ranked 1, 2, 3 for rarity and 2, 1, 3 for diversity. The criteria are also ranked (e.g., rarity = 1 and diversity = 2, see Table 9.3). Each candidate site's rank for each criterion is then multiplied by the criterion's rank, all these values are summed for each site, and the sums are used to rank the sites.

Table 9-3. Ranking evaluation method example.

Candidate Site	Rarity x 1	Diversity x 2	Sum
Site A	1 x 1 = 1	2 x 2 = 4	5
Site B	2 x 1 = 2	1 x 2 = 2	4
Site C	3 x 1 = 3	3 x 2 = 6	9

The ranking evaluation method assumes that each candidate site can be ranked for each criterion (a difficulty if there are many candidate sites), the criteria can be ranked (based on some reasonable basis for relative importance), and the criteria are independent. Moreover, the sums or total scores obtained are the result of mathematically non-permissible numerical operations on ordinal numbers (i.e., the evaluator subjectively ranks each candidate site for each criterion, the criteria are also ranked, and then the two ranks are multiplied).

With this evaluation system, there may be considerable uncertainty in field measurements, variation among people in assigning scores and in the weights given to different criteria, as well as fuzziness in the definitions of the criteria. This is an important consideration for evaluators who want to have a high degree of confidence in the derived scores or ranks in order to defend them and base official plan designations on their accuracy. A Conservation Advisory Committee can help establish criteria and ranking.

9.2 Recommended method for ranking similar habitats

Planning authorities are advised to use the minimum standards evaluation method whenever possible because it provides one of the simplest and most ecologically sound approaches to ranking significant wildlife habitats. Numerous examples of evaluation criteria that can be used with it are listed in the tables in Appendix Q and in Table 8-1. However, only a few key criteria will need to be used to evaluate most candidate sites. These are listed for selected habitats, in Appendix Q. The majority of them are recommended for initial ranking of similar habitats because they can be deduced from available information (maps, aerial photographs, site reports, expert opinion). The effective use of other criteria frequently requires extensive knowledge of each site and/or field investigation.

9.2.1 Importance of representation of habitats

When designing a Natural Heritage System, the most important criterion is "current representation of habitat within the planning area." If identification of wildlife habitats is conducted in a thorough manner, the application of this criterion to the evaluation of these sites will ensure that the full range of wildlife habitats existing within the planning area is included within the Natural Heritage System.

This criterion has other advantages. It applies to most habitats within the four significant wildlife habitat categories and it is easy to use. Usually, evaluators only need to know the number of examples of a specific habitat in order to determine its conservation significance (all under-represented habitats would be considered very important and worthy of some form of protection, regardless of their ranking according to other criteria). Furthermore, field investigations are less likely to be required when this criterion is used.

9.2.2 Establishing minimum standards for representation

It is suggested that whenever habitats appear to be under-represented according to the established minimum number of examples required for adequate representation of the habitat within the planning area, all existing examples should be ranked highly. For many of them, there will be no need to apply additional evaluation criteria.

To ensure adequate representation of habitats within the planning area, two or three examples of a specific habitat, depending on the habitat type, are suggested as minimum standards for the criterion of current representation. This does not mean that more of these habitats cannot be protected but, as a very minimum, the number identified as a standard should be protected. Generally, habitats for species of conservation concern, species sensitive to human activities and disturbances, and rare vegetation communities should automatically be considered highly significant if they are found at three or fewer locations. If there are more than three examples, then other criteria, in addition to 'current representation' should be used to rank them.

For most habitats of more common or less sensitive species (e.g., white-tailed deer) the value of two examples is presented as a reasonable minimum standard for current representation. It must be stressed that this is a minimum standard; i.e. if there are one or two deer yards, they would be significant based on representation; additional deer yards may be significant based on other criteria. Protection of only one habitat example may not provide enough long-term protection for many species. This is particularly true for species of small habitats, isolated habitats, and habitats located near or in developed or settled parts of the planning area. A possible exception to this approach concerns very extensive habitats. For example, a single, large site may be resilient enough to provide significant habitat for a variety of wildlife species for many years.

9.2.3 Minimum standards of other selected evaluation criteria

The choice of minimum standards for evaluation of some criteria is subjective and can be difficult. For example, how many species should be present on a site in order for it to be recognised as significant because of diversity? What should be the minimum size of a site, to be considered significant? How rare would a habitat or species have to be before it was considered significant? The answers to these questions and others will vary across the province depending on the quality and amount of habitat remaining in different planning areas, as well as the knowledge and aims of the evaluators.

The minimum standards in Appendix Q are presented as guidelines. Planning authorities electing to use values other than those provided are urged to develop minimum standards that do not unnecessarily preclude potentially significant sites from consideration. For example, if an objective of the Natural Heritage System were to protect habitat for area-sensitive birds, a minimum standard of 10 ha of forest interior would eliminate smaller sites from consideration, a potentially serious problem in many parts of southern Ontario where forest cover is limited and heavily fragmented. A minimum standard of 4 ha might result in several sites being considered significant or at least being further assessed using other criteria. The use of more generous or inclusive minimum standards represents a more cautious approach to Natural Heritage System planning and design. Since little is known about the specific habitat requirements of many species and because unforeseen future events can destroy or seriously degrade habitats, it seems reasonable to protect more wildlife habitat whenever possible.

Highest conservation significance might be assigned to habitats meeting the greatest number of minimum standards for the evaluation criteria, although any habitat meeting the minimum standards for only one criterion should be considered sufficiently significant to merit some form of protection. No candidate habitats should be considered significant unless they meet a certain minimum standard.

9.2.4 Avoiding numerical values for some minimum standards

There are several reasons why, for some criteria, the use of absolute numerical values for minimum standards has been avoided (e.g., size or numbers of animals occupying a habitat). It is very difficult to develop specific and yet comprehensive minimum standards that can be applied to different landscapes across the province with varying amounts and quality of habitat. What may be considered significant in one area may not be in another. It is hard to assign minimum standards to certain criteria (e.g., level of disturbance, degree of threat, location of habitat). Often these minimum standards are either unknown or poorly understood. For example, spatial area is considered an important criterion when assessing the conservation value of forest stands to area-sensitive bird species. Although most biologists believe that larger, contiguous forests have greater value to these species than smaller patches, they are still learning about the minimum areas required to support local populations and to maintain long-term population viability. A suggested minimum area of 50 ha (a commonly-cited value) could be criticised by some people as being too large or too small. More important, if a forest stand has to be at least 50 ha to be considered significant as habitat for area-sensitive bird species, planning areas with only smaller stands remaining could decide that there is no significant forest habitat for these species in their jurisdiction. However, these smaller patches of forest may have value to some of these birds, as well as local wildlife.

For these reasons, suggested minimum standards for some criteria (e.g., size, diversity) are based on comparisons made between similar habitats. If five sites are to be ranked for diversity, rough estimates of plant and animal diversity for each site can be calculated based on reports about the sites and/or informed opinions from knowledgeable people. A mean diversity value for all five sites can also be easily determined. As a minimum standard for diversity, the diversity of a single site would have to exceed the mean diversity value for all five sites by at least 20 percent.

9.2.5 Explanation of the tables in Appendix Q

The tables in Appendix Q list important evaluation criteria for seasonal concentration habitats, rare vegetation communities or specialised wildlife habitats, and habitats of species of conservation concern that have been discussed in this guide. By definition, many species of conservation concern are rare, declining, or have a large proportion of their global population in Ontario and urgently need some protection. The criteria in Table Q-3 were selected because they are closely tied to the definition of these species and minimum standards for them are more easily derived than for some criteria (e.g., abundance, location of habitat, degree of threat or decline of habitat, ability of habitat to meet species' requirements).

As mentioned earlier, other criteria can be used and the suggested minimum standards are only guidelines. In addition, not all criteria listed in these tables for each habitat need to be used, especially when there are only a few habitats to be ranked. Having several criteria to choose from for each habitat can prove helpful where information for some criteria is unavailable, out-dated, or incomplete. For example, if planning authority staff do not have accurate information about the size of a deer yard or the number of deer it supports, they might rely more on some of the other criteria (current representation, provision of other significant wildlife habitats, provision of suitable habitat or habitat diversity). These criteria are more easily determined from readily available information such as maps, aerial photographs, and from local experts.

Finally, whenever the minimum standard for current representation is met, planning authorities are advised to use at least three evaluation criteria. The highest ranked habitats would meet the minimum standards of the largest number of criteria. Ideally, significant habitats should meet the minimum standards of at least two criteria to reduce the potential for conflict should some people disagree with one of the criteria. There does not need to be a minimum number of habitats that are protected. The number protected should be determined by the number that meet the minimum criteria.

L5

10 How Much Habitat to Protect

After wildlife habitats have been evaluated and ranked to determine the number of habitats to protect, the planning authority may have to decide how much of each individual habitat to protect. When determining specific amounts, the primary guiding principle should be to protect enough habitat to maintain those important functions and conditions of the habitat that enable it to sustain dependent species. For example, a rare plant species might occupy only a few square meters of a forest floor. But in order to adequately protect it, this local population plus some of the surrounding landscape would have to be protected because the adjacent trees help to provide the conditions on which the plants depend (e.g., shade, moisture). A black rat snake hibernaculum is a small (20 square meters or less) but critical component of this species' habitat. However, when the snakes emerge in the spring, they disperse to their summer range, as far as 5 km from the hibernaculum. If a movement corridor and sufficient summer range habitat are not protected, in addition to the hibernaculum, then the snake population will not be sustainable.

Many planning authorities will have situations where they have disparate landscapes within their jurisdiction. This will occur mostly in the south where the landscape is predominantly agricultural or urban, but portions of the planning area may include the Shield, the Niagara Escarpment, or moraines with more extensive natural areas. In addition, some planning authorities may occur in more than one site region. In these instances, it is recommended that different criteria for determining significant wildlife habitat be developed for major physiographic regions and different site regions in the planning area. This avoids having situations where species that are locally at risk in one physiographic area are unprotected, or where onerous conditions for development are imposed because of the presence of an abundant species in a different area.

10.1 Difficulties in determining how much habitat to protect

For several reasons, it is difficult and not always desirable to provide numerical targets for amounts of protected habitats. The specific habitat requirements of many species and the number of individuals of a particular species (each requiring a certain amount of habitat) required to maintain a viable population remains poorly understood. Some individuals within a species show considerable variation in habitat preferences and tolerance to disturbance, even when they are found in the same geographical area.

Often it is difficult to protect sufficient habitat because some species are wide-ranging (e.g. fisher), wandering over many square kilometres; or require several disparate habitats. Habitat quality can influence the amount of required habitat; an animal or population may require a larger area of lower quality habitat to meet its needs. Unfortunately, habitat quality is often hard to assess. In addition, since landscape and wildlife habitats are dynamic and they change over time, present amounts of protected habitat may prove to be inadequate in future.

Since it is often difficult to place boundaries on some habitats because they are not always clearly defined, it is hard to determine how much to protect. Also the width of what should be considered significant wildlife habitat for the same species or type of habitat can vary, depending on specific site conditions (e.g., hilly topography on one site provides better protection for a species that is sensitive to human intrusion, than a flat, more open site). Frequently the minimum width of a setback required to mitigate negative impacts is unknown because impacts on the habitat are unclear or the species' response to a variety of potential impacts varies or has not been studied.

Designating an exact amount of protected habitat for a species can cause some problems. Some people might assume that once specified amounts of habitat have been protected. remaining land in the planning area should be open to development and other uses that can destroy or degrade wildlife habitats. The protection of small islands of habitats is not very effective in truly protecting these features. This concern has been discussed in Section 2. This could lead to a loss of more important wildlife habitats and accelerate the conversion of natural areas to anthropogenic landscapes.

Furthermore, if a certain habitat exists in a planning area, but is smaller than the recommended minimum size, there is the danger that it could be considered insignificant and then receive no protection at all. However, this habitat may still be important to the species of concern and many other wildlife species. A habitat of this size may have excellent potential for rehabilitation.

10.2 Some considerations for determining how much habitat to protect

The above discussion suggests that assigning specific numerical values is best suited to relatively small habitats with reasonably clear boundaries; sedentary species; and habitats and species that have been quite well studied and for which some guidelines exist. It is also apparent that determination of how much habitat to protect is best conducted site by site based on fieldwork and going through a detailed decision-making process.

For most habitats, it is not possible to give precise amounts that should be protected. However, suggested amounts for selected habitats are listed in Table 10-1 and discussed in Section 10.6. The tables in Appendix Q present some minimum standards that may help to determine the amount of habitat that should be protected.

Three key guidelines should be kept in mind when deciding how much habitat to protect. First, the full range of habitats found in the planning area, should be protected. Second, protection of several examples of each habitat type is preferable to protection of only one area. This will also provide some insurance against unforeseen habitat losses and potential opportunities for linkage to other similar habitats and colonisation and restoration of them. Third, it is preferable to protect larger blocks of habitat. Larger habitats are more resilient to adverse disturbance, provide better protection against future habitat loss or degradation, can better maintain important ecological processes and their dependent species, and support more species.

The following considerations can be helpful in determining generally how much habitat should be protected.

Critical requirements of the species

The amount of protected habitat depends on the species or group of species that require it. Some species have strict area requirements. Wildlife such as carnivores and birds of prey require much larger habitats than many herbivorous species. In general, it is more challenging to maintain viable populations of these area-sensitive species because more habitat must be set aside for them and the habitat must include all of their critical habitat requirements. However, protection of habitat for these species benefits many other species as well. Fortunately, sites supporting these species can often be managed for both wildlife and human uses.

Some species have small home ranges, but when they must travel outside this area, they require corridors to move safely over the landscape. Often, these are small animals that rely on vegetation cover to survive. For them, protected habitat must include appropriate corridors. Often their habitats and corridors are found within the home ranges of area-sensitive species.

Some species are sensitive to human activities that disrupt the natural landscape. Some are habitat specialists; they have highly specific habitat requirements and cannot tolerate changes. Others have limited ability to move from where they are found (e.g., numerous plants, insects). For these species, habitat protection must not only focus on how much habitat they require, but also on the most critical components of that habitat. Often the habitat for these species is small, but several protected habitats are often needed as a precaution against unforeseen future disturbance that could destroy one or more of them.

Habitat characteristics

The amount of habitat that should be protected depends on the physical and ecological conditions found on the site, as well as its location. The habitats of some species are susceptible to natural changes and disturbance. As a heronry ages, more nest trees fall down. Beach dunes are built up, moved, and eroded. Habitats located on unstable slopes or on flood plains may be short-lived. Rare vegetation communities such as alvars are supported by very shallow soils that are quite easily removed or severely damaged.

Others habitats are found in somewhat more resilient sites (e.g., maple-beech woodlot, old field). In general, habitats that are susceptible to degradation or destruction by natural processes or human activities are in greatest need of protection.

The quality of a habitat can influence how much of it should be protected. High quality habitats (diversity of structure and composition, relatively pristine, free from human disturbance) often support a greater diversity and sometimes abundance of associated wildlife than similar habitats of poorer quality. Consequently, less high quality habitat may have to be protected than similar, but inferior habitat.

Some habitats, such as tall-grass prairie and oak savannah, require disturbance to maintain and/or restore them. Fire, either of natural origin or a prescribed burn, maintains the species composition. In order to allow a disturbance like fire to operate on a natural spatial and temporal scale, larger amounts of these habitats may have to be protected than habitats that are not dependent on widespread disturbance.

Habitats located close to or in residential or recreational areas or near roads have their associated species at higher risk than similar habitats found in areas with no roads and low population density. As residential areas encroach on natural areas, they may disrupt natural processes such as hydrological cycles, remove natural vegetative cover, and increase human disturbance in the area. They can introduce pest species (non-native plants, house cats, urban species). The presence of roads often increases mortality of wildlife in the area (road-kills, increased access for non-native species, fragmentation of habitat) and encourages use of the surrounding landscape by more people. Protection of greater amounts of these habitats as compared with those under less pressure will be required to offset future habitat deterioration and/or loss.

In southern Ontario, many habitats are fragmented. Perhaps the most commonly mentioned examples are the loss of wetlands and forest cover that used to be far more widespread in this region. Some habitats are now disjunct (i.e. greatly isolated from similar habitats). These habitats are high priority for conservation. Several examples of these habitats should be protected because some will undoubtedly be lost. Ultimately, this will mean that larger amounts of the most disjunct habitats should be protected than similar, but better connected habitats.

Adjacent lands and land uses
The type of landscape and land use adjacent to a wildlife habitat can directly affect how much of a habitat should be protected. If a significant wildlife habitat is adjacent to a natural area, it may be possible to protect less area as significant wildlife habitat, than similar habitats surrounded by incompatible land uses.

Other factors
The amount of natural landscape in the planning area can affect the total amount of wildlife habitat that should be protected. In planning areas with few remaining natural areas, the size of remaining habitats will be smaller than similar habitats in planning areas with more extensive natural areas. However, proportionally more of the natural landscape in developed areas should be protected, relative to the total land area, because they have less to start with and are more likely to be lost to development.

The presence of a greater diversity of natural heritage features and areas increases the amount of habitat that should be protected to represent this increased diversity. However, the presence of already existing protected natural areas such as provincial parks, conservation areas, and wildlife refuges can substantially reduce the amount of additional habitat that should be protected.

Demographic and land use trends can help the planning authority determine the total amount of habitat that should be protected. An increasing human population may increase pressure to develop remaining natural areas. At the same time, many of these people may value natural areas close to home for recreational and educational opportunities, particularly if the population is ageing. Protection of more of these areas will be easier and less expensive now than in the future.

The planning authority may also want to consider what their Natural Heritage System should be in the future. There may be existing habitats that are degraded that have potential to be restored in order to achieve better representation of these habitats within the planning area.

Finally, the design of the Natural Heritage System will affect how much total habitat will be protected. A system that includes as broad a representation of habitats as possible will require the protection of more land than a simpler system. But such a system will also better protect the biodiversity and important ecological processes of the planning area, and provide opportunities for people to appreciate and learn more about the natural world.

10.3 What to protect?- summary of guidelines

Since there are no rules governing the exact amount of habitat that should be protected, the following guidelines are presented to help the planning authority with this decision. They are based on the recognition that the most effective and ecologically sound approach to protecting significant wildlife habitat is by protecting large natural areas, consolidating and connecting habitats wherever possible, and encouraging public appreciation of the conservation value of important natural areas (Chapter 2).

General principles of habitat protection

- When there is some doubt as to how much habitat to protect, it is usually prudent to be conservative and protect more rather than less habitat.
- Whenever possible, several protected examples of a specific habitat are preferable to only one, especially when they are small and isolated from one another.
- Protection of habitat for species guilds or associated species found together is often preferable to habitat protection for a single species.
- Where several species of conservation concern occur together, protection of sufficient habitat for those species requiring more space should also protect less demanding species.
- Some potentially suitable but currently unoccupied habitats might be maintained to provide opportunities for future colonisation, especially where they are connected to other natural areas.

Guidelines for the protection of corridors

- There is no optimum width or length for a corridor but longer corridors increase the probability of mortality, unsuccessful dispersal, and barriers to movement.
- Corridors should be designed taking the requirements of the species inhabiting the planning area and specifically the species using the habitat to be connected into account.
- Ideally, corridors should be as wide as possible to minimise edge effects, accommodate the movement of a greater number of species, and provide more habitat for resident species.
- Corridors surrounded by unsuitable habitat need to be wider.
- Large corridors may provide significant wildlife habitat for many small species of birds, mammals, reptiles, amphibians, and insects.
- Locating and then protecting potentially significant corridors, as well as possibly restoring or improving natural landscape connections, may be more important than trying to determine their optimal width.
- Known wildlife migratory routes should be incorporated into corridors.
- Busy roads should not pass through corridors (corridors should be routed across landscapes with the lowest density of roads).
- Work within the existing landscape. Utility rights-of-way and abandoned railway lines may be useful as corridors.

Priorities for habitat protection

- Highest priority for protection should be given to the best examples of seasonal concentration areas, provincially rare (S1-S3) vegetation communities, habitats of provincially or regionally significant species of conservation concern, and large natural areas with diversity of habitats and communities.

- Sites that support several significant wildlife habitats should be protected.

Habitats to include as significant wildlife habitat

- When identifying and protecting habitat, all critical components of that habitat should be protected. This includes essential adjacent features and functions such as seed sources, groundwater recharge areas, and water quality, as well as all critical parts of a species' habitat. To adequately protect a bird species of concern, its nest site, nesting territory, and foraging habitat should be maintained.
- Many specialised habitats are within larger forested areas (e.g., nesting habitat for area-sensitive species; cavity and supercanopy trees; mast-producing trees; seeps and springs). This implies that protection of larger forested areas should protect many of these specialised habitats associated with it.
- Numerous bird species of conservation concern require relatively large tracts of forest, grassland, or marsh. Protection of these species requires maintenance of large blocks of suitable habitat.
- Corridors that enable animals to move safely over their home range or between critical components of their habitat should be protected. Development should not sever these corridors. A significant wildlife habitat may be rendered useless if animals cannot maintain access to other critical components of their habitat.

Reduce or avoid disturbance

- Regular disturbance may lead to abandonment of habitats and can be especially serious for seasonal concentration habitats (e.g., heronries and other colonial nesting bird sites, raptor and wild turkey wintering areas, bat hibernacula).
- Detrimental edge effects may extend at least 200 meters into forested lands and affect the functions of habitats in these areas.
- Maintaining natural vegetation around significant wildlife habitats may provide improved protection from detrimental edge effects, predators, and human disturbance.
- The size of the area that should be considered significant wildlife habitat will depend on the quality of the habitat, the adjacent land uses, and the sensitivity of the species.
- Many habitats exhibit a subtle structural complexity that, if altered, may result in habitat abandonment (e.g. interior forest habitat).
- For some habitats (e.g., colonial-nesting birds), seasonal control of human access may be the only protection required.

Protection of sites with high potential

- Management may be required to maintain and improve some of these habitats (e.g., tall-grass prairie, and savannah).
- Some rare vegetation communities (e.g., tall-grass prairie) can be restored on sites where they once existed.
- Management guidelines to maintain and improve some of these habitats have been developed by the OMNR and other agencies (Appendix R). Silvicultural activities can

be conducted according to guidelines designed to protect and sometimes enhance the distribution and supply of specialised habitats such as cavity trees, down woody debris, pockets of conifer cover, raptor nest trees, and supercanopy trees.

- Some management activities designed to encourage the enhancement of habitats (e.g., snags, and cavity trees, down woody debris, denning sites) are long-term projects conducted over several decades.
- Agencies may be very interested in the management of specific significant wildlife habitats are listed in Chapter 11.

Development

- Where development is inevitable, the negative impacts on some of these habitats can be somewhat mitigated, by directing it away from core areas. See the *Significant Wildlife Habitat Decision Support System* for potential mitigation techniques.

Public education

- A public education campaign may help to protect some habitats, especially if they are near residential areas. It could also lead to less disturbance of wildlife by people.
- Increased public awareness of significant habitats and the principles of why they should be protected may facilitate protection of them.

Incentives

- Grants may be available for restoration projects (see Chapter 11).
- There are agencies that focus on rehabilitation and restoration of degraded habitats (Appendix F).

10.4 How much to protect?- summary of factors to consider

Decisions concerning how much habitat to protect should be based on the most recent research, as well as habitat management guidelines developed by the OMNR and other wildlife conservation agencies. The OMNR can provide guidelines for white-tailed deer, moose, some colonial birds, raptors, and bullfrogs (Appendix R). Many of the guidelines were developed for forest management planning, but the principles on which the recommendations were made are valid for land use planning applications as well.

The following factors will also influence the amount of habitat that should be protected.

- size of the habitat or site
- historical distribution of habitat in the planning area
- amount of currently protected habitat
- amount of potential habitat in the planning area
- presence of rare species and their degree of rarity (i.e., rarer species may require stronger protection which can mean protecting several habitat locations or a larger single habitat that supports them)

- location of habitat can help to determine how much area should be included as significant wildlife habitat and needs to be protected
- if important components of a species' habitat go beyond the identified habitat (e.g., foraging areas, summer range), this will increase the amount of habitat that should be protected
- other areas and features that affect the quality of the habitat or on which the habitat depends (e.g., headwater, groundwater recharge area) may increase the amount of habitat that should be protected
- area requirement of the species (see habitat matricesin Appendix G)
- species' sensitivity to disturbance to help to determine how large a habitat should be protected, and if a corridor is required
- abundance of species at the site
- quality of the habitat, often smaller amounts of higher quality habitats will need to be protected than habitats of lower quality
- incompatible adjacent land uses may require a larger area to be identified as significant wildlife habitat and more stringent protection

10.5 How much to protect?- suggested amounts

Table 10-1 lists some selected habitats and species that might be protected. It is important to note that most of these habitats form just one habitat component among several within the home range of a species. It is necessary to protect all these critical habitats for a species in addition to protecting natural connections to these habitats. The suggested guidelines attempt to address the question of how much total habitat should be protected, and where possible, numerical values are suggested. Also refer to the wildlife habitat matrices in Appendix G for average home ranges for selected species. To improve the probability of providing adequate habitat for a species or guild, the planning authority should try to protect several examples of each habitat, as outlined in Appendix Q.

Table 10-1. Suggested values for protection of selected wildlife habitats.

Habitat/Species/ Guild	**Suggested Guidelines**
10-1-1 Seasonal Concentration Areas	
White-tailed deer winter yard	• protect the entire area of the deer yard • core areas in yards less than 10 km^2 should be entirely protected • protect at least 85% of core areas in larger yards • from a landscape perspective, ideally 10-30% of total deer range should be conifer-dominated stands, with a minimum conifer component of 70% and crown closure of 60% • ideally a minimum of 40% of deer range should be second growth or regenerating stands, occurring within 800 m of conifer shelter • as much as 300 m around certain deer yards may have to be protected if disturbance or other factors may affect the functions of the habitat
Moose late winter habitat	• protect the complete area of the site • in addition, protect sufficient conifer forest and patches of conifers within hardwood forests to support number of moose in the planning area based on OMNR biologist estimates • as much as an additional 300 m may need to be protected to ensure maintenance of functions
Colonial-nesting birds	• protect the area of the site • protect an additional area to protect the birds from disturbance. The width of this area will vary depending on sensitivity of birds, local site conditions, and adjacent land use (see Appendix C and the Decision Support System)
Raptor wintering areas (hunting, roosting)	• protect the area of the site • protect several large blocks of fields (minimum of 15 ha, preferably much larger) • protect key roosting sites adjacent to these areas • an additional 100 m width adjacent to this habitat may have to be protected to ensure that raptors are not disturbed
Landbird/shorebird/ butterfly migratory stopover area	• protect the area of the site • since the minimum threshold size of this habitat is unknown, existing significant sites should be protected in their entirety and not be reduced in area • protection of undisturbed sites with a diversity of suitable habitats and structure will improve the sustainability of long-term populations • for shorebirds, an additional 100 m may have to be protected to ensure the birds are not disturbed
Wild turkey winter range	• protect the area of the site • this habitat is best protected by protecting as many mature conifer stands and patches of conifers within hardwood stands, as well as springs and seeps, as possible • an additional 100 m or more may need to be protected so that birds are not disturbed

Turkey vulture summer roost	• protect the area of the site • additional areas that should be considered part of the significant wildlife habitat will vary according to local site conditions (e.g., height of cliff, adjacent land use, local topography, how remote the site is)
Bat/reptile hibernacula	• protect the area of the site • protection of all bat hibernacula is desirable because this habitat is limited • protect an additional 200 m from the entrance to bat hibernacula, although individual site inspections may find that a smaller protected area will provide adequate protection • this habitat for snakes is best protected by maintaining a variety of protected natural areas (see Chapter 2)
Bullfrog concentration area	• protect the area of the site • protection of wetlands and undisturbed shorelines will help to maintain long-term populations and fish habitat

10-1-2 Rare Vegetation Communities or Specialised Habitat for Wildlife

Rare vegetation communities	• protect the area of the site • the amount of area that should be protected will vary depending on species' sensitivity to disturbance, adjacent land uses, area of community, hydrological conditions
Marten and fisher denning sites	• protect the area of the site • protect as many large blocks of contiguous mid-aged to mature forest as possible • the area protected may be larger if disturbance becomes a problem (an additional 100 m)
Mink and otter feeding/denning sites	• protect the area of the site • protect as much wetland and undeveloped, undisturbed shorelines on lakes, rivers, and streams as possible • a large area may need to be protected if disturbance becomes a problem (100 m)
Moose aquatic feeding areas	• protect the area of the site • protect as much wetland and undeveloped, undisturbed shorelines on lakes and rivers as possible (potential target of 2% of planning area in well distributed aquatic feeding areas) • width of the area that should be protected depends on local site conditions, adjacent land use, importance of site to moose
Moose calving areas	• protect the area of the site • protect as much undeveloped, undisturbed shorelines on lakes, rivers, and islands as possible • additional area (200 m) may have to be protected if there is potential for disturbance
Moose mineral lick	• protect the area of the site • protect as many large blocks of contiguous forest as possible • a larger area may be required if site is exposed to disturbance (100-200 m)
Black bear/other mammal foraging areas	• protect the area of the site • protect as many large blocks of contiguous forest with food species and associated openings as possible • a larger area may be required if site is exposed to disturbance (100-200 m)

Waterfowl nesting habitat	• protect the area of the site (approximately 120 m of upland grassland cover within water) • protect as many upland grassland areas adjacent to wetlands and other water bodies • the entire area encompassing several small ponds should be protected
Waterfowl staging areas	• protect the area of the site • protect large wetlands and shorelines of large water bodies • an additional 100 to 300 m may have to be protected depending on sensitivity of birds, local site conditions, and adjacent land use
Osprey nesting habitat	• protect the area of the site • protect as much wetland and undeveloped, undisturbed shorelines (and islands) of large lakes and rivers as possible • protect large trees adjacent to wetlands and water bodies • an additional 100 m for Ospreys may be required if the area is subject to disturbance
Raptor hunting areas	• protect the area of the site • protect as many large (minimum of 10 ha, preferably larger), contiguous blocks of undisturbed grasslands as possible • a larger area may be necessary for sites surrounded by incompatible land uses (e.g., 100 m)
Sites supporting area-sensitive forest species	• protect the area of the site • where they exist, protect blocks of forest of at least 30 ha, and preferably with 50 ha or more • protect forest patches with at least 4 ha forest interior, and preferably larger areas • protection of as much forest as possible, with a variety of age classes, structure, and composition will provide important habitat for many other wildlife species • in areas with little remaining forest cover, but where presettlement forest cover was high, a long-term recovery objective might be to eventually have 30% of planning area in native forest cover (Chapter 11)
Woodland amphibian breeding ponds	• protect the area of the site • protect as many ponds (including vernal ponds) and adjacent woodlands as possible • the amount of area that requires protection will vary depending on local site conditions such as slope, amount of riparian vegetation, high water mark, height and density of adjacent trees, and groundwater and surface water conditions
Turtle nesting areas	• protect the area of the site • protect as many undeveloped, undisturbed shorelines with sandy soils • an additional 30 to 100 m may have to be protected depending on local site conditions such as slope, amount of vegetation, adjacent land use, and the amount of nest predation
Old-growth or mature forest stands	• protect the area of the site • protect as many mature stands as possible

Forest stands providing a diversity of habitats	• protect the area of the site • protect as much forest with a variety of age classes, structure and composition as possible • maintain at least six cavity trees per ha; one supercanopy tree (tree taller than the remainder of the woodland) per 4 ha; at least seven or eight mast-producing trees of each species per ha
Areas of high diversity	• protect the area of the site • protect a good representation of these sites • more area may be required, particularly if the site is surrounded by incompatible land use
Cliffs, caves	• protect the area of the site or portion of the site where habitat value appears to be the greatest (e.g., ledge where birds nest or roost) and provide additional area if required • the area protected will vary depending on local site conditions amount of vegetation, amount of disturbance, size of site; a buffer may not be required
Seeps, springs	• protect the area of the site or portion of the site where habitat value appears to be the greatest • size of the habitat protected will vary depending on local site conditions such as slope, amount of vegetation, height and density of adjacent trees, groundwater conditions • protect recharge areas
10-1-3 Habitat of Species of Conservation Concern	
Raptors	• protect the area of the site and an area of at least 200 m around active nests (some species are more tolerant and smaller areas may suffice) • protect the largest and oldest contiguous forests of at least 30 ha (preferably 50 to over 100 ha) or the largest existing forest blocks remaining in the planning area • protect areas around inactive nests as well, as they may be re-used • plan for no reduction in area of existing forest cover in the planning area • plan for no increase in forest fragmentation in the planning area • there should be no activities permitted within 200 m of an active nest during the nesting season (Mar 1- Aug. 1 [Sept. 1 in northern areas])
Area-sensitive birds	• protect the area of the site • protect large contiguous forests or grasslands with at least 4 ha (preferably at least 10 ha or more) of interior or the remaining forests and grasslands with the largest existing interiors • maintain as much forest cover in the landscape as possible (ideally 30% forest cover) • plan for no reduction in area of existing forest or large grassland • plan for no increase in fragmentation of forest or large grassland cover
Grassland birds	• protect the area of the site • protect largest contiguous undisturbed grasslands of at least 30 ha (preferably 50 ha or more) or the largest existing expanse of grassland in the planning area • additional area may be required for sites surrounded by incompatible land use (200 m)

Amphibians	• protect the area of the site • protect best examples of suitable habitat for the species of concern • in general, protect as many wetlands and breeding ponds as possible • additional area may be required around significant breeding ponds
Reptiles	• protect the area of the site • protect all known hibernacula • protect all known nesting sites • protect best examples of suitable habitat for the species of concern • in general, protect a diversity of natural areas, and protect areas of suitable habitat in areas where specific species are known to occur • buffers may be required around hibernacula and nest sites
Mammals	• protect the area of the site • protect best examples of suitable habitat for the species of concern • in general, protect a diversity of natural areas • protect as much forest, wetland, undisturbed grassland, and shoreline as possible
Insects	• protect the area of the site • protect several colonies of species' food plant • protect best examples of suitable habitat for the species of concern • in general, protect areas with diversity of plant species
Plants	• protect the area of the site • additional area may be required to protect sensitive species or sites surrounded by incompatible land use • in general, protect a diversity of natural areas

10.6 Some hypothetical examples

The following hypothetical examples are presented to illustrate some of the questions that should be asked when trying to determine how much habitat to protect. The answers are based on the considerations, principles, and factors discussed in Sections 10.2 to10.4. In this guide, this process is necessarily brief. In reality, sites would usually be more rigorously assessed and might be displayed in a matrix that would make the comparison of sites easier. While there may be no absolute answers regarding the amount of habitat to protect, it is hoped that as much as possible of all types of significant wildlife habitats will be appropriately protected. The purpose of providing these examples is to give those identifying significant wildlife the flexibility to determine those sites with the greatest value to wildlife.

Example 1: Seasonal Concentration Area

1. What is the significant wildlife habitat to be protected?
waterfowl nesting/breeding habitat

2. Background
How many sites have been identified?
6

Approximate size of the site:
Hard to estimate, but if we consider breeding habitat as consisting of nest sites and some brood habitat for the young ducklings, then:

Site 1 is at least 50 ha
Site 2 is at least 100 ha
Site 3 is approximately 20 ha
Sites 4 and 5 are both less than 10 ha (areas in a marsh)
Site 6 is 5 ha (creek and adjacent fields).

Is the site found on private or public land?
Five of the 6 sites are entirely on private land. Site 1 is largely on a conservation authority property.

What species use the site?
Primarily mallards on all sites; blue-winged teal also nest on Sites 1, 2, 3; American black duck on Sites 4, 6; there are records for green-winged teal (*OMNR Wetland Evaluation*) on Site 2 and gadwall on Site 3 (local landowner).

Other species regularly observed on Sites 1 to 3 include American coot, common moorhen, common merganser, pied-billed grebe, Canada goose, wood duck, great blue heron, and green heron. Pied-billed grebe, Canada geese, American bittern, and great blue heron are commonly seen on Sites 4 and 5. Great Blue Herons are seen on Site 6.

Does the habitat support species of conservation concern?
Yes. Site 2 has supported a colony of black terns, and green-winged teal have nested there (*OMNR Wetland Evaluation*). Apparently gadwall are nesting regularly on Site 3 (local landowner).

There is an old record (1970) of a spotted turtle on Site 6.

Are population estimates for the site available?
No. But aerial photograph interpretation of potentially suitable habitat tends to indicate that Sites 1 to 3 would probably support the largest numbers of breeding waterfowl. Site 6 would appear to support the fewest birds.

If so, approximately how many individuals use the site?
Unknown. Perhaps local landowners, others could help conduct a survey once ducks and ducklings are on the water.

Does the species depend on a corridor?
Yes.

Is there a corridor?
All sites have some sort of corridor that could help ducklings to move safely from the nest to the water. However, on Site 1 a gravel road cuts through a considerable amount of nesting habitat and could threaten ducklings if traffic were heavy (which is unlikely).

Describe the corridor.
From aerial photographs, all corridors appear to be brushy fields that should provide sufficient cover. The corridor on Site 1 appears somewhat fragmented by summer mowing of grass in the picnic area and a gravel road.

Is the corridor continuous or severed? Describe.
Only on Site 1- severed by a gravel road. However, the road may not be very busy during the nesting season. (Check with CA office. If so, maybe they could place a warning sign on the road).

Are there existing guidelines for the species or habitat?
No, but Ducks Unlimited and the local OMNR biologist would probably agree to visit some of the sites to assess them and provide some advice. There is good knowledge of the nesting habitat requirements of all the species.

Is the habitat part of a larger natural area?
Sites 1, 2, 4, and 5 are part of larger natural areas. Site 3 was but now the area has been developed with estate housing along the river. Site 6 is the only natural area.

Habitat description:
Site 1: fields (ranging from 2 to10 ha) in varying successional stages along the shore of a river. Shoreline is mainly irregular with lots of cover and aquatic vegetation and invertebrates. Fishing is good, and there are many frogs.

Site 2: fields (ranging from about 2 to 20 ha) and large marsh along a big lake. Part of the lake is very shallow and weedy in the summer. It is also very productive (*OMNR Wetland Evaluation*). There are wooded upland areas extending into the fields along the lake. This is a Provincially Significant Wetland.

Site 3: consists of fields along a river. Some of the fields are very shrubby with numerous small trees. The shoreline is quite regular. Vegetation (both shoreline and aquatic) has been cleared along the stretches where homes front on the river.

Site 4 and 5: are primarily marshes with open water areas.

Site 6: is a meandering narrow creek with varying amounts of aquatic and riparian vegetation. Fields appear to be ideal nesting habitat and they are found on both sides of the creek. However, they are rather narrow (approximately 50 to 150 m wide).

What is the approximate quality of the habitat for the species?
Not sure. All sites were selected because their breeding/nesting habitat represents the best in the area. Aerial photograph interpretation indicates that all sites have good nesting habitat, but Sites 1, 2, 4, and 5 also appear to have the best brood habitat (lots of cover and food for young ducklings). Perhaps OMNR Biologist or Ducks Unlimited personnel can help evaluate the habitat.

Describe the adjacent landscape.
The adjacent landscape of Sites 1 and 2 is largely natural. There is both forest and open field habitat around Site 1. Much of Site 2 is surrounded by upland forest. Residential housing is scattered. Farming (beef and dairy cattle, corn) is a major land use. Large estate housing dominates landscape adjacent to Site 3. There are lots for sale. Upland forest is found around much of Site 4. Land use is primarily residential housing with some farming (cash crop). Upland forest and agricultural cropland is found adjacent to Site 5. Land use is primarily residential housing. Site 6 is in the middle of cropland (corn and soybeans).

Are there important features located outside the site that help to maintain the site?
Need to investigate. Site 1 may be subject to water level fluctuation since flow volume is seasonally controlled through a series of small dams.

Cattle grazing and mowing of hay may be delaying natural succession and maintaining nesting habitat on Sites 2, 4, and 5.

Is the site disturbed by human activities? If so, what are they?
Breeding period is from approximately mid April to mid August for late broods.

Site 1: most use of the Conservation Area is during July and August and consists of primarily human foot traffic—hikers, joggers, bathers, and people walking their dogs. Some people launch canoes and boats from the ramp; fishing pressure is relatively light. Disturbance to nesting areas is probably light because most people stay on the nature trails or around the beach. Some of this habitat may be mowed (find out).

Site 2: most use is during July and August by anglers fishing the weedy shoreline for bass. There may be disturbance to some nest sites from haying operations, some disturbance to broods by anglers.

Site 3: human activity occurs year round, but with highest boating disturbance during July and August. Domestic dogs and cats may be a problem in the nesting habitat but there is no information about this.

Sites 4 and 5: mowing is probably the greatest threat to nesting habitat but this may occur sporadically and on only some parts of the sites.

Site 6: No apparent disturbance, but agricultural effluent run-off into creek upstream may be affecting water quality and aquatic organisms that might have effects on waterfowl.

What are the major concerns about protecting the habitat for this species/guild?
- disruption of nesting habitat (e.g., loss of grasslands, large cavity trees)
- disruption of brood-rearing habitat (e.g., loss of riparian vegetation and thick cover in the wetland)
- disruption of water levels (i.e., fluctuating water levels can destroy nests)
- water quality
- disturbance during nesting period from haying operations and nest predators

- disruption by roads of movement of broods to the water

Other concerns:

- Other values of the habitat (e.g., economic, recreational). Throughout the year, school groups use the Conservation Area for outdoor education, waterfowl watches are a common component of these programs. A small number of residents enjoy duck hunting, although some of them have complained that the hunting is not what it used to be because duck numbers are down.
- what is required to manage this habitat?
- what is the level of public awareness of this habitat?

3. What sites should be protected?

Selected sites for protection:

Sites with the highest priority for protection are 1, 2, 4, and 6. Table 10-2 summarises the minimum standards for the six sites.

Table 10-2. Minimum standards for nesting waterfowl for six hypothetical sites.

Minimum Standard	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Number of waterfowl species	2	3	3	2	1	2
Large numbers of waterfowl	√	√	√			
Good brood habitat	√	√		√	√	
Number of waterfowl species of conservation concern	0	1	1	1	0	0
Number of other species of conservation concern	0	1	0	0	0	1
Other natural heritage features		√				
Long-term sustainability	√	√		√	√	

Rationale for protecting four sites:

- Four protected sites would provide better representation of these habitats as well as better long-term protection in case of loss or severe degradation of one or more of these areas.
- More protected habitat will allow for greater diversity of nesting habitat structure/composition, making nesting habitat more attractive to a greater diversity of waterfowl.
- These sites appear to have the best nesting and brood rearing habitat.
- Sites 1 and 2 support a good diversity of wildlife.
- Site 1 is primarily on a conservation authority property where protection of the habitat from human activities should be relatively easy to ensure (e.g., corridor can be improved, nesting habitat can be managed).
- Site 2 is a Provincially Significant Wetland and all of its important habitats should be protected.
- Site 2 has supported species of conservation concern.
- The future of Site 3 appears to be in doubt and the long-term sustainability of this habitat would be difficult to maintain.

- This planning area has a substantial amount of waterfowl nesting/breeding habitat. Site 6 is small and there are other better habitats.

Is there a minimum area standard for this species?

Yes: √ No:

- At least 120 m of nesting habitat adjacent to wetlands and other waterbodies should be protected since over 90 percent of waterfowl nests are likely to occur within 120 m of water.

4. How much habitat to protect

Recommended amount of habitat to protect and rationale:

- Based on this minimum standard area, a band of nesting habitat adjacent to the water of at least 120 m wide on the most significant sites (Sites 1, 2, 4, 5) should be protected. On Sites 1 and 2, more than this minimum amount could probably be protected without too much difficulty.
- The adjacent riparian vegetation and littoral zone should also be protected as brood-rearing habitat.

Additional protection:

- All shoreline within 100 m of the nesting area should be maintained (i.e., vegetation should not be removed, no deposition of fill, creation of beaches).
- Landowners on Sites 4 and 5 should be encouraged to time haying operations to avoid the peak nesting period. They should be encouraged to use "flushing bars" (see Ducks Unlimited for information).
- Conservation authority personnel should be apprised of the nesting habitat and appropriate habitat management measures (e.g., no mowing during the nesting season). The gravel road through the nesting habitat might be closed if such a measure is warranted.
- No current need for buffer zones since disturbance is minimal.

Example 2: Rare or Specialised Habitat

1. What is the significant wildlife habitat to be protected?

woodland amphibian breeding ponds

2. Background

How many sites have been identified?

Several. The planning authority lies within two major physiographic regions. Part of the planning area is on the Canadian Shield, while the remainder is on agricultural land south of the Shield. Woodland breeding ponds for amphibians are abundant and too numerous to count on the shield. However, information is not available for many of them. There are three known sites on lands south of the Shield.

Approximate size of the sites:
The size of sites on the Shield varies from tiny (a few square metres) to large beaver ponds that are several hectares in area. The sizes of the three off-Shield sites are presented below. In addition to these areas, there are other woodland pools, but they are very ephemeral and do not hold water long enough for larvae or tadpoles to transform into adults. Therefore, they are not viable habitat for breeding amphibians, other than for American toads, which are abundant in the area and use a variety of non-woodland pools for breeding.

Sites south of the Shield:
Site 1 is 10 ha
Site 2 is 2 ha
Site 3 is 0.5 ha

Is the site found on private or public land?
All sites are on private land.

Habitat description:
Amphibian breeding ponds on the Shield are variable, but generally fall into the following categories:

- small ephemeral pools that dry up by June;
- larger ephemeral pools that usually contain water until near the end of July;
- permanent, isolated ponds that do not contain fish; and
- permanent ponds with fish populations.

Sites 1 and 2 off-Shield are permanent ponds located in deciduous forest. Site 1 is located on a creek that has been dammed by beavers. There is abundant shoreline vegetation and adjacent canopy closure is high. Site 2 is a wetland depression. Shoreline vegetation is limited due to heavy shading that inhibits wetland vegetation growth. The surrounding forest is more open.

Site 3 is an ephemeral pond in a small, mature maple woodlot. There is some shoreline vegetation. Canopy closure is high.

Is there a diversity of microhabitats (e.g., downed logs, seeps, and cavity trees) in the vicinity of the site? If so, describe them.
Sites on the Shield are too variable and numerous to describe. The off-Shield sites are described below:

Site 1 has a good diversity of microhabitats attractive to a variety of wildlife. Down woody debris is especially abundant.
Site 2 has few microhabitats.
Site 3 has a few cavity trees and snags.

Does the habitat support species of conservation concern?
None are known from any of the sites.

What species use the site?

Extremely variable on the Shield. Very ephemeral ponds are used mostly by spring peepers, but only if there is good vegetation cover and considerable woody cover in the pond. These ponds may also be used by toads, particularly if the ponds are not far from forest edge.

Ponds that dry up, but have water that persists until late July, may support a range of amphibian breeding species. These include mole salamanders (mostly blue-spotted salamanders and rarely spotted salamanders), gray tree frogs, wood frogs, leopard frogs, spring peepers, and toads.

Permanent ponds without fish may support all of the above species plus green frogs and bullfrogs. Red-spotted newts may also be present. Some permanent ponds in the north of the planning area support mink frogs, which are at the southern extent of their range here.

Green frogs and bullfrogs dominate permanent ponds with fish. Small populations of other frog species may be present.

Species breeding in the off-Shield ponds are mostly frogs. Spring peepers, chorus frogs, gray tree frogs, and wood frogs breed on all 3 sites. Blue-spotted salamanders are known from Site 1.

What is the approximate abundance of individuals?

Very variable on the Shield, and no information is available for many sites. General information is provided below under approximate species diversity.

Off the Shield, Sites 1 and 3 appear to be packed with frogs. Spring frog song choruses are said to be very loud on Site 3 (local landowner information).

What is approximate species diversity?

Species diversity on the Shield depends on several factors such as permanence of the pond, how large it is, whether there are fish that may prey on eggs and larvae, proximity of other woodland pools, and the surrounding habitat. Latitude also affects species diversity, with mink frogs only occurring in the north. Generally, ponds that have the following characteristics have the greatest species diversity:

- permanent ponds that can support species such as green frog and bullfrog
- ponds that hold water until at least the end of July
- ponds without fish
- large ponds
- ponds surrounded by natural habitat
- ponds in close proximity to other wetlands.

A system of several small ponds in close proximity will support the greatest number of species. Wood frogs are likely to occur only in ponds within extensively forested areas or in large forest patches. Bullfrogs usually occur only in larger, open ponds with full sunlight. Leopard frogs and toads are more likely to occur in ponds near forest openings or edges.

In the off-Shield ponds, Site 1 probably supports the highest diversity of amphibians. According to knowledgeable sources, the diversity of other wildlife also appears highest at this site (e.g., turtles, waterfowl, herons, beaver).

Are there existing guidelines for the species or habitat?
No. However, OMNR forest management guidelines could be used to protect and maintain this habitat.

Is the site part of a larger natural area?
The sites on the Shield are part of an extensively forested area that is predominantly natural except for roads and cottage development around lakes. All three off-Shield sites are part of larger natural areas. Site 3 is located within the smallest natural area.

Is the site isolated?
Most on-Shield sites are adjacent to natural areas. Off the Shield, Sites 1 and 2 are not isolated; there are other small ponds and wet areas in the vicinity. Site 3 appears to be isolated.

What is the approximate quality of the habitat? Is there good habitat structure?
Limited data for the on-Shield sites. Site 1 off-Shield has the best habitat: permanent water, lots of shoreline vegetation and closed canopy forest near the pond. Site 2 appears to have poor habitat and yet there are many frogs. Site 3 has intermediate habitat.

Describe the adjacent landscape.
Not defined for most of the Shield sites. Site 1: mature deciduous forest (approximately 120 ha) with a little-used bush road leading to the pond.

Site 2: young, open, mixed-deciduous forest (approximately 30 ha). There are several trails.

Site 3: mature deciduous forest (approximately 20 ha) with numerous openings in the canopy. Fallen logs are common.

Is there natural cover around the breeding ponds?
Not described for on-Shield ponds.

Sites 1 and 3 have some surrounding natural habitat.

Site 2 is quite open and has no adjacent natural habitat.

Are there important features located outside the site that help to maintain the site?
Not described for on-Shield ponds.

Site 1 may be affected by the creek that flows through it and beaver dams may be affecting water levels and flow rates.

Site 2: unknown

Site 3 is probably highly dependent on the continued existence of the surrounding woodlot. If the trees are removed or thinned substantially, this pond could dry out too much to support breeding amphibians. In addition, the local topography on and perhaps off the site may be largely responsible for the existence of this pond.

Are population estimates for the site available?
No.

If so, approximately how many individuals use the site?
Unknown, but perhaps local naturalists and school groups could conduct spring counts to provide some of this information and the CAC provides input.

Does the species depend on a corridor?
Yes, several of the species do because they spend much of the summer in the adjacent forest, and some, such as the leopard frog and toad, may move to open habitats in summer.

Is there a corridor?
Yes for Sites 1 and 3.

Describe the corridor.
Site 1 and 3: forested with lush understorey vegetation.

Is the corridor continuous or severed? Describe.
Corridors are very short and intact.

Is the site disturbed by human activities? If so, what are they?
Disturbance on Sites 1 and 2 is probably low.

Site 3 may be more disturbed. Landowner is removing some of the older trees adjacent to the pond.

What are the major concerns about protecting this habitat?

- There should be no disruption of the breeding pond.
- Water quality, riparian vegetation, and adjacent wooded areas must be maintained.
- Canopy closure in adjacent forest must be maintained.
- Amphibians must be able to move safely to summer range

Other concerns:

- What is the level of public awareness of this habitat?

3. What habitats should be protected?

Selected sites for protection and rationale:

Preferably, all three off-Shield sites should be protected in some way. Table 10-3 summarises the minimum standards for them.

Table 10-3. Minimum standards for three hypothetical off-shield amphibian breeding ponds.

Minimum Standard	Site 1	Site 2	Site 3
Representation	√	√	√
Permanence	√	√	
Abundance of amphibians	√		√
Large size	√		
Suitable adjacent habitat	√	√	√
Low disturbance	√	√	
Other significant wildlife habitat	√	√	

Rationale for protecting all three sites:

- Three protected sites provide better representation of this habitat and better long-term protection in case of loss or severe degradation of one or more of these sites.
- Site 1 should receive top priority for protection since it is the largest site, has high quality habitat, supports the greatest diversity (and probably abundance) of amphibians and other wildlife, and is part of the largest natural area.
- Amphibians in general are not common in this physiographic region of the planning area. Although the species that do occur are common to abundant in the site region and also in the portion of the planning area that is on the Shield, breeding sites are very limited off-Shield in the planning area. Loss of breeding ponds could result in extirpation of species in the agricultural areas.
- All three sites meet a minimum standard as described in Chapter 9 as demonstrated above.

Decisions on what should be protected on the Shield are more complicated. If development pressure is low, there may be no need to identify any frog-breeding ponds as significant wildlife habitat. Even if this is the case, the best ponds for mink frog breeding might be designated, as this is a locally significant species of conservation concern. Also, minimum standards should be applied. Representation of all types of amphibian breeding ponds should be maintained, and sufficient habitat should be protected to ensure that all of the amphibians that currently occur on the Shield continue to have sufficient breeding habitat.

If there is development activity on the Shield, the most important breeding ponds should be designated significant wildlife habitat. In order to do this, the planning authority should make sure that good breeding ponds have been identified for all species that occur. The general habitat characteristics of these species can be determined by checking the habitat matrices appended to this document (Appendix G), and also by looking at the appropriate indices in the *Significant Wildlife Habitat Decision Support System*. An alternative to identifying individual ponds as significant wildlife habitat would be simply to require that proponents describe the significance of all woodland pools for amphibian breeding in an impact statement. This approach might avoid the potential for overlooking some significant sites, or designating some ponds that are of lesser importance than some that have not been designated.

Is there a minimum area standard for this species?

Yes: No: √

The final amount protected habitat should address the concerns listed above. Permitted land uses and amount of protected habitat might best be based on individual site inspections.

4. How much habitat to protect

Recommended amount of habitat to protect and rationale:

The breeding pond should be protected as well as some additional woodland around the pond to minimise disturbance and maintain essential habitat components such as riparian vegetation and shade. The size and composition of the additional area that should be considered part of the significant wildlife habitat should be determined in an Impact Assessment.

For the breeding pond to continue to function over time, it must remain connected through a corridor to the surrounding woodland. Protecting an area beyond the pond itself may provide the corridor if it links the pond to suitable forest that can be used by more terrestrial amphibians.

Additional protection

- Landowners on Site 1 should be apprised of the significant wildlife habitat and urged not to destroy the beaver dams on the creek.
- These landowners should also be asked to try to maintain a high canopy closure within 150 m of the pond.
- Landowners may be advised of programs such as the OMNR Community Wildlife Involvement Program (CWIP) that provides grants for wildlife habitat improvement. There may also be groups that are interested in improving habitat on the property.

Example 3: Habitat of Species of Conservation Concern

1. What is the significant wildlife habitat to be protected?

Habitat for the southern flying squirrel, a vulnerable species.

2. Background

How many occurrences of the species/habitat are known from the planning area?

Three current records from scattered locations across the planning area.

Why is this species designated as a species of conservation concern?

Globally, nationally, or provincially rare: √

Regionally rare: √

Locally rare: √

Species declining:

Other reason (e.g., species of economic value):

Is the species a member of a larger group or guild of species with similar habitat requirements?
Yes. Birds and mammals that require cavities in trees.

Is the species/guild dependent on or found in seasonal concentrations or rare or specialised habitat?
specialised habitat: forest with an abundance of cavity trees

seasonal concentration area: during winter months several squirrels may use the same cavity tree

Are there other species of conservation concern that occur at the site?
All three sites support rare plants and forest bird species of conservation concern.

How likely is it that the species occurrence represents a disjunct (isolated) population?
Unlikely. The planning area has moderate forest cover (approximately 35 percent), much of it affording suitable habitat for this species. This species is hard to detect since it is nocturnal.

Are there guidelines to protect this species?
No. However, OMNR silvicultural guidelines can be applied to protect the habitat (specifically maintenance of required density of cavity trees). Silvicultural guidelines may also be used to protect and enhance food species (oak, hickory, beech, etc. –Appendix R).

Site description:
Site 1 (approximately 35 ha) and Site 2 (approximately 10 ha) are dry-mesic deciduous stands of primarily red oak, white oak, and some white pine.

Site 3 (approximately 4 ha) is a mesic deciduous stand consisting of mainly sugar maple.

Describe existing habitat for the species and the quality.
Site 1 would appear to be good habitat for this species. It is a relatively large and mature forest for the planning area. There are numerous large trees with cavities suitable for nesting and denning by this species. The dominant tree species, oaks and white pine, probably provide abundant mast during most years.

Site 2 appears to have inferior but adequate habitat for this species. The supply of seeds, nuts, and fungi are probably sufficient for several squirrels, large cavity trees are uncommon (approximately 1 to 3/ha).

Site 3 may represent inferior habitat. It is probably too small to support more than a few animals. The shortage of cavity trees appears to be the major limiting factor. Forest size may also be a limiting factor, as well as competition for cavities by the grey squirrel.

Is there additional habitat associated with this habitat?

All sites have a natural buffer of forest.

Describe the adjacent landscape.

The landscape adjacent to all sites is agricultural land with numerous roads and houses.

There are a few small woodlots (approximately 5 ha) within 1 to 2 km of Site 3.

Are there important features located outside the site that help to maintain the site?

Unknown.

Is the site disturbed by human activities? If so, what are they?

All sites have been disturbed by logging. Landowners are removing dead, dying, and hazardous trees that are often cavity trees.

What are the major concerns about protecting the habitat for this species/guild?

- Maintenance of cavity trees and forage (e.g., mast trees)
- Disruption of nesting and rearing activities
- No disturbance to animals in winter from timber operations
- Predators (e.g. domestic cats)

Other concerns:

- What management is required to protect its habitat?
- What is the level of public awareness of this species and its conservation status?
- What management is required to ensure a continued food supply?

3. What sites should be protected?

Selected sites for protection and rationale:

All 3 sites should be protected in their entirety. Table 10-3 summarises the minimum standards for the three sites.

Table 10-4. Minimum standards of three hypothetical woodlots for southern flying squirrels.

Minimum Standard	Site 1	Site 2	Site 3
Representation	√	√	√
Good habitat	√		
Large size	√		
Other species of conservation concern	√	√	√

Rationale for protecting all three sites:

- Protection of these sites would benefit not only this species of concern, but many other wildlife species that are dependent on forests.
- These sites support other species of conservation concern.
- Three protected sites provide better representation of this habitat; one or more sites could be lost or severely degraded quite easily (e.g., removal of cavity trees).
- Site 1 should receive the highest protection priority because it likely supports the most squirrels, it may be providing significant seasonal concentration habitat for other squirrels, and the abundant supply of cavity trees is probably important to other wildlife.
- Although Site 3 is not as good, there are opportunities to enhance habitat.

Is there a minimum area standard for this species?

Yes: No: √

- Home range for a single male squirrel may be about 1.5 to 2 ha depending on the quality of the habitat. However, larger forests (e.g., at least 20 ha) of suitable habitat support more squirrels and contribute more to long-term population viability.

4. How much habitat to protect

Recommended amount of habitat to protect and rationale:

- Site 1: protect the entire 35 ha.
- Site 2: protect the entire 10 ha.
- Site 3: protect the entire 4 ha.

Additional protection:

- A public education program stressing the importance of local forests to wildlife and humans in the planning area would help to involve landowners in forest protection and restoration programs.
- Remaining forest stands should not be fragmented.

- Further loss of forest cover should be minimised.
- Local naturalist groups might be interested in monitoring the population.

Additional comments:
The southern flying squirrel is a very difficult to detect species. Over time, it is likely that additional sites for it will be discovered in the planning area. In this event, new and old sites should be re-evaluated. Because of the small size of Site 3, it may not be capable to sustaining a long-term population. If better sites were found, there may be less need to protect Site 3 for southern flying squirrels, although it still may be protected to maintain populations of the other species of conservation concern that it supports. Local groups may want to enhance this site through tree planting or other management techniques.

10.7 General habitat requirements of species of conservation concern

The broad habitat requirements of many species of wildlife are quite well understood. Some of these are summarised below in Tables 10.5 to 10.7 in an attempt to demonstrate the overlap in wildlife habitats. The important point is that an effective Natural Heritage System can be constructed by protecting substantial amounts of those habitats that appear repeatedly in these tables.

10.7.1 Seasonal concentration areas

Table 10.5 provides an overview of where seasonal concentration areas are most likely to be found. Forests, shorelines, and wetlands provide much of this very important habitat. More specifically, older forests and in southern Ontario, some coniferous forests, are especially significant because of the larger trees and the variety of habitat they afford wildlife. The most important shorelines appear to be those adjacent to forests or wetlands, with weedy shallows. Large fields with abundant vegetation and scattered trees and shrubs are important open country habitat. Important wetlands are likely to be large and obviously productive.

Table 10-5. Primary locations of seasonal concentrations of wildlife.

Type of Seasonal Concentration	Primary Location of Habitat	Notes/Key Requirements
Bat hibernacula	• specific site—cave, mine	• often in forested area • undisturbed habitat is essential
White-tailed deer winter yard	• forests with at least 60 % canopy closure	• conifer cover (white cedar, hemlock) particularly important in southern Ontario • corridor required; undisturbed habitat is important

Type of Seasonal Concentration	Primary Location of Habitat	Notes/Key Requirements
Moose late winter habitat	• coniferous forests	• corridor required
Reptile hibernacula	• site specific	• often in large forested areas, depending on species • rocky outcrops, talus slopes • corridor required
Amphibian summer habitat	• wetlands, shorelines, other riparian areas	• corridor required
Bullfrog concentration areas	• permanent wetlands, shorelines, other riparian areas	• permanent water
Raptor wintering areas	• undisturbed fields for hunting small mammals (mice, voles)	• adjacent forests for roosting of some species; undisturbed habitat is important
Wild turkey winter range	• coniferous forests • spring and seeps	• pockets of conifers may suffice • nearby food source
Turkey vulture summer roost	• specific site	• undisturbed habitat is important
Waterfowl breeding/staging/areas	• wetlands • shorelines of water bodies with emergent vegetation	• larger wetlands preferred for staging and moulting • grassy/shrubby areas for nesting
Colonial bird nesting sites (gulls, terns, double-crested cormorants)	• islands, shoals, peninsulas, and some shorelines	• undisturbed habitat during nesting season is essential • treed swamps
Heronries	• wetlands (swamps) • lake and river shorelines • forests	• undisturbed habitat during nesting season is essential
Colonial bird nesting sites (heronries, marsh birds)	• wetlands	• undisturbed habitat during nesting season is essential
Landbird migratory stopover area	• open water shorelines with adjacent mature forests, old-fields and grasslands • forest cover along watercourses, forested ravines	• Great Lakes shorelines and adjacent lands within 5 km (especially Lake Erie & Lake Ontario) are very important
Shorebird migratory stopover areas	• shorelines of water bodies (rivers, large lakes), marshes	• key is undisturbed shorelines • Great Lakes shorelines (especially Lake Erie & Lake Ontario) are very important
Butterfly migratory stopover areas	• shorelines of large lakes • forest, old field, and undisturbed open lands	• Great Lakes shorelines and adjacent lands within 5 km (especially Lake Ontario & Lake Erie) are very important • Fields with milkweed very important habitat for monarch butterflies

10.7.2 Rare or specialised habitats

Table 10-6 provides an overview of where rare or specialised habitats are most likely to be found. Closer examination of this table reveals considerable repetition in habitats for different wildlife. In particular, it shows how important forests, wetlands, and shorelines are to many species; more specifically, large, mature, relatively unfragmented forests and shorelines adjacent to forested areas. In addition, many species require undisturbed areas and corridors permitting safe movement throughout their home ranges.

This table helps to emphasise the importance of protecting adequate representation of these habitats within a Natural Heritage System. Also, cooperation among adjacent planning authorities can contribute greatly to the long-term protection of wide-ranging, area-sensitive species.

Table 10-6. Primary locations of rare or specialised habitats.

Type of Habitat	Primary Location of Habitat	Notes/Key Requirements
Marten and fisher denning sites	• large forests, especially mature and unfragmented	• area-sensitive species • corridor required • large undisturbed areas are important
Moose aquatic feeding area	• weedy shorelines and bays with adjacent forest cover • wetlands	• requires forested corridor • undisturbed areas are important
Moose calving sites	• forested islands • shorelines, especially peninsulas	• requires forested corridor • undisturbed areas are essential
Moose mineral lick	• forest openings with adjacent forest	• specific site that is very hard to find • forested corridor required • undisturbed areas are important
Black bear/mammal foraging area	• specific sites with abundance of berries, grasses, mast-producing trees • relatively mature, undisturbed forests	• forested corridor required
Osprey nesting habitat	• forested shorelines (often along large lakes) • wetlands • islands	• undisturbed areas are important • shallow-water feeding areas

Type of Habitat	Primary Location of Habitat	Notes/Key Requirements
Woodlands supporting amphibian breeding ponds	• forests; often associated with wetlands, but may be in upland forests	• corridor required
Old-growth or mature forest stands	• forests	• exceedingly rare, therefore the oldest forests in the planning area are usually the best candidates
Sites supporting area-sensitive species	• largest areas of unfragmented forests, grasslands, wetlands	• mature, closed canopy forests with multiple vegetation strata preferred by many species of forest birds • minimum size of these areas may be at least 30 ha, but may be larger than 100 ha
Waterfowl nesting, staging habitat	• wetlands, water bodies, and adjacent grasslands within 120 m of water	• undisturbed habitat during nesting season is important
Mink and otter feeding/denning sites	• shorelines of lakes, rivers, creeks (riparian areas) • wetlands	• corridor required • undisturbed habitat may be required
Turtle nesting areas	• shorelines (sand/gravel), wetlands	• corridor required • undisturbed nesting habitat is preferred
Raptor hunting areas	• undisturbed open fields	• minimum of 15 ha, preferably larger than 30 to 50 ha
Areas of high diversity	• often forested areas • often larger natural areas with diversity of habitats including wetlands	• sites may have remarkable diversity of just one group (e.g., plants, insects), several groups (e.g., plants, birds, reptiles, amphibians), or several community types (e.g., forest, wetland)
Cliffs	• anywhere – associated with geological features such as the Niagara Escarpment	• cliffs in undisturbed natural areas may have value to more wildlife species
Caves	• anywhere – associated with specific geological features	• larger, natural caves are more common in areas of limestone
Seeps and springs	• often in forested land with slopes • headwater areas	• usually hard to find, specific sites with several natural heritage values

10.7.3 Habitat of species of conservation concern

Biologists, for various reasons, consider some wildlife to be species of conservation concern. Sometimes this is because Ontario supports a large proportion of their total global population. Often they are rare and/or their numbers in Ontario are declining. Current low numbers of a few species may be due to exploitation (bullfrogs and some waterfowl) or persecution (snakes). Some species may not compete well with other species that share their range (e.g., southern flying squirrel, red-shouldered hawk) while others may never have been very common in the province (Fowler's toad).

Table 10-7 provides an overview of the broader habitat requirements of some of these species and is organised around the major ecosystems: forests, wetlands, grasslands, and shorelines. Many species are found in several habitats. Refer to Appendix G (wildlife habitat matrices) for a more extensive list with their specific habitat requirements and geographic location. Often they have specialised habitat requirements. and many are sensitive to human disturbance.

Most species will be protected if sufficient amounts of these four ecosystems are placed within a natural heritage system of protected areas (see Chapter 2). Cooperation among adjacent planning authorities and landowners can do much to protect wide-ranging species. For example, they might agree to jointly protect significant conservation areas that cross township or county boundaries, and make their joint cooperation known to the residents through signs and interpretative trails stressing the importance of larger, unfragmented natural areas to a variety of wildlife.

Table 10-7. General habitat requirements of selected species of conservation concern.

Species/Guild of Conservation Concern	Forest	Wetland	Grassland	Shoreline
Five-lined skink	• Abundant down woody debris, other ground structure (e.g., rocks)			• ground debris
Eastern Massasauga rattlesnake	• larger forests with abundant down woody debris, rocky openings	• hibernates in karst habitat wetlands	• hunts in wet meadows	• may feed in riparian habitat

Species/Guild of Conservation Concern	Forest	Wetland	Grassland	Shoreline
Eastern hognose snake	• larger forests with abundant down woody debris			• sandy soil, with toad and other amphibian prey, adjacent to larger forests
Black rat snake	• larger forests with abundant down woody debris			
Wood turtle	• river flood plains, flowing water			
Eastern spiny softshell turtle		• abundant aquatic vegetation and moderately deep water		• abundant aquatic vegetation
Spotted turtle		• aquatic vegetation		
Amphibians	• woodland breeding ponds			
Fowler's toad				• sandy areas
Bullfrogs				• aquatic vegetation • permanent water
Area –sensitive birds (See habitat matrices–Appendix G)	• large unfragmented forests with diversity of vertical structure	• large swamps, marshes, bogs, or fens	• large, unfragmented areas of grassland	
Southern flying squirrel	• mature deciduous woods			
West Virginia white butterfly	• moist mature deciduous forest with riparian features • toothwort			

Species/Guild of Conservation Concern	Forest	Wetland	Grassland	Shoreline
Karner blue butterfly			- grasslands with lupines	- lupine - beach dunes
Frosted elfin butterfly			- prefers pine-oak savannah	- beach dunes
Numerous other butterflies (e.g., monarch)			- grasslands for food and host plants	

Again the importance of forest ecosystems is clear, especially larger, more mature forests with some water and abundant down woody debris. Shorelines are very important habitats for many species of conservation concern, especially those with sandy soils and adjacent water with abundant emergent and submergent vegetation. Many species of conservation concern are dependent on healthy, relatively undisturbed wetlands.

11 Assessment of the Natural Heritage System

The first ten chapters of this technical document focus on identifying and prioritising significant wildlife habitat. There are, however, six other types of natural heritage features identified in the Natural Heritage Component of the Provincial Policy Statement. To be ecologically functional, the best examples of all of the natural heritage features should be identified and protected. The mosaic of natural heritage features on the landscape and the connections among them is known as a Natural Heritage System (OMNR 1999).

The other natural heritage features (in addition to significant wildlife habitat) are significant wetlands, the significant portions of the habitat of endangered and threatened species, significant woodlands, significant valleylands, significant ANSI's, and fish habitat. Methods for identifying and protecting these features are presented in the *Natural Heritage Reference Manual* (OMNR 1999) and supporting technical documents, where available.

Once all natural heritage features have been identified, they should be mapped. This map then should be closely examined to see if a functional natural heritage system has been put in place. Key questions to ask:

Are there examples of all seven types of natural heritage features on the map? Note that there may be no examples of some of these in certain planning authority's jurisdictions. For instance, there may be no endangered or threatened species, significant wetlands, or ANSI's in some municipalities. Significant woodlands and valleylands are not designated on the Canadian Shield. Conceivably, planning authorities that straddle the Shield could have significant woodlands or valleylands in part of their jurisdiction, but not on the Shield. If not all types of natural heritage features are represented in the municipality, the planning authority should confirm that they do not exist and have not been overlooked.

Is all fish habitat adequately protected by the natural heritage system? Unlike the other six types of natural heritage features, where the best examples are protected, all fish habitat is considered equal under the federal Fisheries Act. If development is allowed to proceed that have negative impacts on fish habitat, the proponent and possibly even the planning authority may be in contravention of the Fisheries Act.

Are there good connections among natural areas? If there are isolated areas, thought should be given to connecting them to the remainder of the natural heritage system. This may not need to be a corridor per se, but it could be a series of smaller natural areas that could act as stepping stones for species travelling across the landscape. Some of the evaluated natural heritage features (i.e. non significant wetlands or wildlife habitat) that did not stand out as best examples might be included in the natural heritage system if they fulfil a linkage function.

11.1 Gap analysis

A gap analysis is the process of determining what is unrepresented or under represented from a planning area. The OMNR techniques for undertaking a gap analysis are presented in Appendix E. It should be referred to for more detail, but a brief overview is provided below.

After the natural heritage system has been mapped and examined in the above broad fashion, it should be looked at in more detail. The first step, if it were not undertaken during initial phases, should be to break the planning area into physiographic units. This could be done at a variety of scales:

- Site region. Some planning areas will be in more than one site region.
- Site district. Many planning areas will be in more than one site district.
- Physiographic area. Most planning areas will have more than one physiographic unit within their boundaries, as defined by Chapman and Putnam (1984).
- Soil types. All planning areas will contain more than one soil type.

All of these units (where applicable) should be indicated on the natural heritage system map. Then each of the types of natural heritage features should be re-examined to see if they are adequately represented in each physiographic unit.

This analysis may reveal large disparities within the natural heritage system. For instance, all of the significant woodlands may be in one physiographic unit, and unrepresented in others. If most of the municipality were on a forested moraine, it may have been decided that significant woodlands should be 30 ha in size. By applying this criterion to the entire municipality, none of the woodlands on till plains may have met the size criterion. Once the planning area is subdivided into physiographic units, it may be obvious that there is a need for more than one set of criteria. In this example, woodlands as small as 4 ha or even 2 ha might be significant on the till plain although the 30 ha criteria may remain in place on the forested moraine.

Wetlands are another good example. Using the same scenario, the moraine may have several significant wetlands as well as many other wetlands that did not achieve provincial significance. On the till plain, there may be no significant wetlands according to the wetland evaluation system and the PPS. Wetlands in general may be small and rare on this physiographic unit, so the planning authority may wish to protect the best examples of these wetlands.

At the broad scale, the natural heritage system should be evaluated for distribution of natural areas and features within the physiographic units that the planning authority has decided to use. Once this has been completed and criteria adjusted as necessary to ensure as complete a representation as possible within each unit, it is time to look at it at a finer scale. Failure to look holistically at natural heritage features at least within major physiographic units may result in certain significant features being overlooked, subsequently lost, and possibly unnecessary challenges of the natural heritage system at the Ontario Municipal Board.

11.1.1 Gap analysis of vegetation communities

As part of the process of identifying significant woodlands, wetlands, and wildlife habitat. it is likely that planning authorities will have a good idea of what vegetation communities occur within their jurisdiction. Examination of FRI maps. air photos. watershed studies. and other information will help confirm vegetation community types. The distribution of vegetation communities should be examined within the entire municipality and within the different physiographic units.

This is frequently a very enlightening process. It may become apparent that there are certain rare habitats throughout the planning area. In this case, they could be considered significant wildlife habitat for the entire municipality. What is often surprising is that some of the most common vegetation communities in the planning area may be rare or unrepresented in some physiographic units. For example, upland white cedar coniferous forest may be common to abundant on the portion of the planning area that is on the Shield. but rare in the agricultural portion of the area. Disparities in the distribution of vegetation communities may be even more profound if the planning authority is examined at the soil-type level.

Certain planning areas may contain small portions of a different forest region. For example, some may have Carolinian and Great-Lakes St. Lawrence forest regions, or Great-Lakes St. Lawrence and Boreal forest regions. It is essential that good representation of each type be maintained.

As in the case of looking at the broad scale of distribution of the major types of natural heritage features, it may be necessary to have different criteria for vegetation communities by physiographic unit to ensure good representation within the planning area.

There may have been vegetation communities within the planning area that no longer exist. Prairies and savannahs are classic examples, with less than one percent of the original coverage of these habitats remaining. Many wetlands have also been lost (about 70 percent in the south), so that certain types of wetlands may have been lost entirely from the planning area, or wetlands may have disappeared from certain physiographic units.

One source of information for determining historical vegetation community distribution is the notes of the original land surveyors. They were commissioned to survey the land before extensive land clearing. This information has been mapped and is available from the Ministry of Citizenship, Culture, and Recreation, and from the Natural Heritage Information Centre. The quality of this information varies, depending on the interest and identification skills of the surveyor. However, these maps may be invaluable in identifying areas where there were prairies, savannahs, specific forest types and wetlands.

Another technique for identifying where wetlands previously occurred, is to examine older topographical and soil maps. Areas on old topographical maps where there are wetland symbols or organic soils indicated on soil maps were likely previous wetlands. A series of wetland approximation maps has been prepared using this information. The maps are available from Environment Canada.

The current distribution of vegetation communities within the planning authority's jurisdiction compared to historical times may give a very good indication of which communities are currently poorly represented and, if rehabilitation is planned, where it can be focused.

11.1.2 Gap analysis of species

At the finest level of gap analysis, planning authorities should look at the distribution of species within their jurisdiction. This, of course, requires a more intimate knowledge of the ecology of the area than looking at vegetation communities.

Initially, this might be done at a guild level, by lumping species with similar broad habitat characteristics together. For instance, by examining the various atlases, it may become apparent that area-sensitive bird species and amphibians are well distributed in the portion of the planning area that is on the Niagara Escarpment, but rare to absent on the clay plain below it. Again, different criteria for the maintenance of habitat for these species should be derived for different physiographic units. This analysis will also demonstrate which species are lacking habitat in certain portions of the planning area.

A gap analysis for individual species may also be undertaken. This may be done at the physiographic unit level within the planning area, or species that are lacking from the planning area entirely may be identified. This may be done by consulting the various atlases, knowledgeable individuals, and a CAC, if the planning authority has one.

Some species appear to be shifting their ranges southward, such as ravens, black bears, and fishers. Planning authorities that are currently near the range of these species (where they still do not occur) should consider if there is a need to provide habitat for them. In certain cases, it may be necessary to consider whether these species are desirable in the planning area before attempting to rehabilitate habitat for them. For instance, in a planning area that is experiencing significant human population growth, it may not be desirable to encourage black bears.

By examining the atlases, particularly, the breeding bird atlas, it may become apparent that certain species occur adjacent, or even all around, the planning area, but are absent within it. In these instances, these species may be targets for restoration work to provide habitat for them.

11.2 Restoration and rehabilitation opportunities

Gap analysis will have identified what natural heritage features, vegetation communities, species and functions are absent from all or a portion of the planning area, and also what features are degraded and would benefit from rehabilitation.

Many organisations and local clubs are actively involved in habitat and species restoration. A small number of examples are listed in Appendix F. The gap analysis described above may provide a starting point for restoration efforts within a planning area.

Several excellent documents deal with habitat restoration and rehabilitation. Planning authorities as well as private organisations that wish to improve their natural environment are urged to consult them.

Riley and Mohr (1994) summarise the ecological principals behind establishing a natural heritage system, and identify municipalities that were deficient in forest cover.

Noss (1995) provides valuable information on using physiographic units as the basis for ecological frameworks.

A manual prepared by Environment Canada, OMNR, and the Ministry of the Environment (1998) identifies targets for habitat restoration for aquatic and terrestrial habitats, and indicates which species might be expected at lower thresholds of restoration.

The Waterfront Regeneration Trust (1995) have a book on restoring natural habitats. This is a practical manual that gives advice on how to decide what to restore, and then how to do it.

The Temperate Wetland Restoration Guidelines (OMNR, Canadian Wildlife Service, and Ducks Unlimited Canada, 1998) describe the ecology of wetlands and provide step-by-step details on how to create or restore a wetland. This manual goes through the entire process from initial planning to as-built drawings and monitoring requirements.

It is recommended that before habitat restoration and rehabilitation efforts be considered the proponent should consult the aforementioned publications. Some of them define the philosophy and rationale for conducting restoration; some provide targets, while others are how-to manuals.

Several sources of funding may be available to those wishing to undertake habitat restoration. Many of these funds are channelled through government agencies and nationally or provincially based private organisations. Funding sources and partnerships change depending on agency priorities. It is recommended that the agencies listed in Appendix F be contacted to inquire about available programs and partnership opportunities. Some specific programs and suggestions are provided below:

- The Community Fisheries/Wildlife Involvement Program (CFWIP) is sponsored by OMNR. Projects that involve habitat improvements for fisheries and/or wildlife may be funded. Generally, OMNR will fund materials necessary for habitat rehabilitation work if labour required to conduct the work is volunteered by a group or landowner.

- The Eastern Joint Habitat Venture (EJHV) encourages conservation and restoration of wildlife habitat, particularly if it benefits waterfowl and contributes to achieving the goals of the North American Waterfowl Management Plan. Grants are given to landowners and stakeholders that improve habitats, especially wetlands.

- Ducks Unlimited Canada will provide assessments of habitat restoration and creation on private and public land if it has the potential to improve habitat for waterfowl. If there will be positive benefits, Ducks Unlimited will do the necessary habitat management provided that the landowner enters into a long-term agreement to protect the habitat. Management undertaken by Ducks Unlimited and also those projects funded by the Eastern Joint Habitat Venture may assist planning authorities in achieving their targets for certain habitat types and species. Wetlands created for waterfowl also benefit all other groups of wildlife and contribute to biodiversity.

- The planning authority should check to see if it is in a Great Lakes Area of Concern (AOC). The International Joint Commission has identified these areas as having significantly degraded water quality. Sixteen of these sites occur in Ontario, and the objective is to improve habitat in all of them so that they can be de-listed. Rehabilitation plans are in place for all sixteen sites. If restoration plans of the municipality are likely to contribute to the rehabilitation programs identified for the AOC, the Great Lakes Cleanup Fund may assist with funding.

- Local conservation authorities may have programs for private landowners that help defray costs of habitat restoration, such as for tree planting. Co-ordination with the conservation authority may help to target landowners where a high priority for habitat management has been identified.

- If there are highly significant habitats within the municipality, such as Carolinian forests, prairies, or savannahs, groups such as Carolinian Canada, the Nature Conservancy, the World Wildlife Fund, Wildlife Habitat Canada and Wetlands International may be interested in assisting with habitat restoration.

- Consider setting up a foundation that raises funds from the public. This has been a proven success at many natural areas (e.g. Second Marsh). This needs a dedicated core of individuals who can effectively communicate goals, needs, and results to the public.

12 References

12.1 Literature Cited

Bakowsky, W.D. 1996. Natural heritage resources of Ontario: S-ranks for communities in site regions 6 and 7. Ontario Ministry of Natural Resources, Natural Heritage Information Centre, Peterborough. Draft.

Beechey, T.J. 1980. A framework for the conservation of Ontario's biological heritage. Ontario Ministry of Natural Resources. Parks and Recreational Areas Branch, Toronto, ON.

Brownell, V.R. and B.M.H. Larson. 1995. An evaluation framework for natural areas in the regional municipality of Ottawa-Carelton: Volume 1. Regional Municipality of Ottawa-Carleton, Ottawa. 120 p.

Catling, P.M. and V.R. Brownell. 1995. A review of the alvars of the Great Lakes region. Distribution, floristic composition, biogeography and protection. Can. Field-Naturalist. 109:143-171.

Chapman, L.J., and D.F. Putnam. 1984. The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2, 270p

Crins, W.J. and P.S. Kor. 1999. Natural heritage gap analysis methodologies used by the Ontario Ministry of Natural Resources. Ontario Ministry of Natural Resources, Natural Heritage Section. Draft

Domon, G. and Y. Bergeron. 1987. Development of synthetic criteria for the ecological evaluation of woodlots and woodlot units. Environmental Management 11:667-673.

Environment Canada, Ontario Ministry of Natural Resources and the Ontario Ministry of the Environment. 1998. A framework for guiding habitat rehabilitation in Great Lakes Area of Concern. Canada-Ontario Remedial Action Plan Steering Committee.

Farrar, J.L. 1995. Trees in Canada. Canadian Forest Service, Fitzhenry & Whiteside Limited, Markham, ON.

Geomatics International Inc. 1991. Environmentally Sensitive Area Study. Addendum report,. Regional Municipality of Halton Planning and Development Department. 2 volumes.

Hills, G.A. 1959. A ready reference to the description of the land of Ontario and its productivity. Ontario Department of Lands and Forests, Research Division Preliminary Report, 141 p.

Lee, H., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario First approximation and its application. Ontario Ministry of Natural Resource, Southcentral Sciences Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

NCASI. 1996. The National Gap Analysis Program: Ecological assumptions and sensitivity to uncertainty. National Council of the Paper Industry for Air and Stream Improvement, Inc. Technical Bulletin No. 270. North Carolina. U.S.A.

Noss, R.F. 1995. Maintaining ecological integrity in representative reserve networks. A World Wildlife Fund Canada/World Wildlife Fund-United States Discussion Paper. 77p.

Noss, R.F. and A.Y. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. Island Press, Washington, DC. 416 p.

OMNR 1999. Natural Heritage Reference Manual for Policy 2.3 of the Provincial Policy Statement. Ontario Ministry of Natural Resources. 127 p

OMNR, CWS and Ducks Unlimited. 1998. The Temperate Wetland Restoration Guidelines.

Ontario Wildlife Working Group. 1991. Looking ahead: a wild life strategy for Ontario. Ontario Ministry of Natural Resources, Queens Printers, Toronto. 172 p.

Riley, J.L. and P. Mohr. 1994. The natural heritage of southern Ontario's settled landscapes. A review of conservation and restoration ecology for land-use and landscape planning. Ontario Ministry of Natural Resources, Southern Region. Aurora, Science and Technology Transfer, Technical Report TR-001. 78pp.

Smith, P.G.R and J.A.Theberge 1986. A review of criteria for evaluating natural areas. Environmental Management 10: 715-734

Villard, M.-A., K. Freemark and G. Merriam. 1992. Metapopulation theory and neotropical migrant birds in temperate forests: an equilibrium investigation. Pp. 474–482, *in*, J.M. Hagan and D.W. Johnson (eds.) Ecology and Conservation of Neotropical Landbirds Smithsonian Institution Press. 609 pp.

Waterfront Regeneration Trust. 1995 Restoring natural habitats. A manual for habitat restoration in the Greater Toronto Bioregion. Waterfront Regeneration Trust, Toronto.179 pp.

12.2 Glossary

Alvar - naturally open areas of thin soils over essentially flat limestone, dolostone or marble rock, supporting sparse vegetation cover of shrine and herbs.

Aquatic feeding area – sites, generally marsh habitat, that contain aquatic vegetation rich in sodium (pondweeds, water milfoil, and yellow water lily) with sufficient shoreline cover that is frequented by moose to replenish sodium supplies.

Biodiversity – the variability among organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species and ecosystems.

Bog – nutrient-poor, acidic wetlands comprised primarily of peat-covered areas with a high water table.

Calving site – an isolated area providing cover and escape paths from predators that moose utilize on an annual basis to give birth. Generally, these are elevated areas on peninsulas or islands.

Colonial nesting – species that nest in colonies, large groups.

Corridor – the naturally vegetated or potential re-vegetated areas that link or border natural areas and provide ecological functions such as habitat, passage, hydrological flow, connection or buffering from adjacent impacts. They can occur across or along uplands, lowlands or slopes. Ravine, valley, river and stream corridors are further defined as landform depressions, usually with water flowing through or standing in them for some period of the year.

Cumulative impacts – the sum of all individual impacts occurring over space and time, including those of the foreseeable future.

Ecological site district – a subdivision of a site region based on characteristic pattern of physiographic features which set apart fairly large areas from one another.

Ecological site region – an area of land within which the resource of vegetation to the features of the landform follows a consistent pattern. Each specific type of land (defined in terms of relief, texture and petrography of geologic materials, depth of bedrock and drainage conditions) within a specific region has it characteristic plant succession. Since an ecological site region is the integration of all the landscape features within a prescribed area, it can best be defined as a region of potential biological productivity.

Ecosystem – any area with a boundary through which the input or output of energy and materials can be measured and related to some unifying factor, and includes the living and non-living environment together with the non-living components of their environment, related ecological process and humans.

Ecosystem Land Classification (ELC) – the Canadian classification of lands from an ecological perspective: an approach to identify ecologically similar areas.

Endangered - any native species that, on the basis of the best available scientific evidence, is at risk of extinction or extirpation throughout all or a significant portion of its Ontario range if the limiting factors are not reversed.

Endemic – a species or taxon naturally occurring only in a particular geographical area/range.

Exotic species – a non-indigenous species introduced into an area.

Extinct - any species formally native to Ontario that no longer exists.

Extirpated - any native species no longer existing in the wild in Ontario, but existing elsewhere in the wild.

Fen – peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed pear near the base. Sedge species form the dominant vegetation of fens; mosses may be present or absent.

Forbs –a broad leave herbaceous (non-woody) plant

FRI (Forest Resource Inventory) – a resource inventory of Ontario forests based on an interpretation of aerial photography. Photo-interpreters use field data of sample plots (such as tree species, basal area, age and height) and aerial photography to delineate forest stand boundaries and describe forest stands. Descriptions are then transferred to Ontario Base Maps, FRI is designed to provide a snap-shot picture of existing forest conditions and a data base for decision-making and planning for a variety of resource managers.

Guilds – species which are grouped together because of common strategies and/or use of areas for life cycle stages.

Hibernacula – a protected area with stable non-freezing temperatures, such as a cave, where bats survive the winter, or a burrow where snakes do the same.

Indigenous – species which have originate naturally in a particular region or environment

Mineral lick – an area of upwelling groundwater rich in sodium, generally surrounded by forest cover that is visited by moose in spring to replenish sodium supplies.

Moraine – a knobby ridge either of (a) boulder clay built by a thrust of a glacier or of (b) gravel and sand deposited at the edge of glacier by escaping meltwater.

Natural heritage features and areas – means features and areas, such as significant wetlands, fish habitat, significant woodlands south and east of the Canadian Shield, significant valleylands south and east of the Canadian Shield, significant portions of habitat of endangered and threatened species, significant wildlife habitat, and significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area.

Patch – in a landscape, a non-linear surface differing in appearance from its surroundings.

Significant wildlife habitat – ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system.

Talus – a sloping mass of rock fragments at the base of a cliff.

Threatened -any native species that, on the basis of the best available scientific evidence, is at risk of becoming endangered throughout all or a significant portion of its Ontario range if limiting factors are not reversed.

Vulnerable - any native species that, on the basis of the best available scientific evidence, is a species of special concern in Ontario, but is not a threatened or endangered species.

APPENDIX A

A Description of Ramsar Sites, Biosphere Reserves, Carolinian Canada Sites and Western Hemisphere Shorebird Reserve Network and Their Application in Land Use Planning

Appendix A provides a description of natural heritage features and areas that have been recognised as significant at the international or national level. Due to their recognition by the scientific community, planning authorities are also encouraged to recognise these sites.

RAMSAR SITES

A RAMSAR site is a wetland designated under the *Convention on Wetlands* as internationally significant based on a variety of criteria including ecological, biological and hydrological functions and values.

The *Convention on Wetlands of International Importance*, often referred to as the Ramsar Convention from its place of adoption in 1971 in Iran, is an international treaty, which provides the framework for international cooperation for the conservation of wetland habitats.

Canada became a Contracting Party to the Ramsar Convention in 1981. Contracting Parties to the Convention recognise that wetlands are essential not only for their hydrological and ecological processes, but also for the rich fauna and flora they support. The broad objectives of the Convention are to stem the loss of wetlands and to ensure their conservation and sustainable use for future generations. There are presently 114 Contracting Parties to the Convention, with 975 wetland sites, totalling 70.7 million hectares designated for inclusion in the Ramsar list of *Wetlands of International Importance*.

There are three criteria for identifying *Wetlands of International Importance*. They are:

1. Quantitative criteria for identifying wetlands of importance to waterfowl.

   A wetland should be considered internationally important if it:
   a) regularly supports either 10,000 ducks, geese and swans; or 10,000 coots; or 20,000 waders (shorebirds), or
   b) regularly supports one percent of the individuals in a population of one species or subspecies of waterfowl, or
   c) regularly supports one percent of the breeding pairs in a population of one species or subspecies of waterfowl.

2. General criteria for identifying wetlands of importance to plants or animals.

A wetland should be considered internationally important if it:

a) supports an appreciable number of a rare, vulnerable or endangered species or subspecies of plant or animal, or
b) is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna, or
c) is of special value as the habitat of plants or animals at a critical stage of their biological cycles, or
d) is of special value for its endemic plant or animal species or communities.

3. Criteria for assessing the value of representative or unique wetlands.

A wetland should be considered internationally important if it is a particularly good example of a specific type of wetland characteristic of its region.

As of January 1999, Canada has designated 36 wetlands as Ramsar sites. Eight of these sites are in Ontario (Figure A-1). The wetland sites in southern Ontario have also been evaluated using the OMNR's Wetland Evaluation System and are also designated as provincially significant wetlands. All of these wetlands are of global importance and should be recognised by planning authorities.

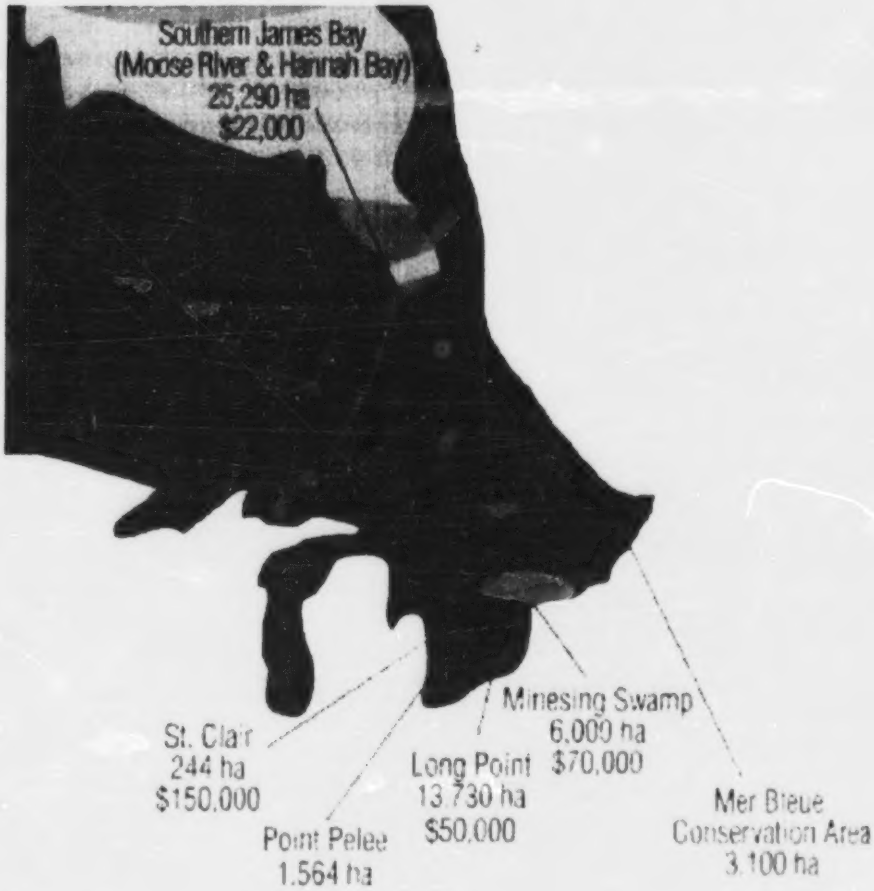


Figure A-1. Location of RAMSAR sites in Ontario.

For additional information please refer to:

Canadian Ramsar Site – http://wetlands.ca/wetcentre/wetcanada/wetcanada.html

Canada and the Ramsar Convention –
http://wetlands.ca/wetcentre/wetcanada/RAMSAR/booklet/booklet.html

The Ramsar List of Wetlands – http://www.ramsar.org/key_sitelist.htm

BIOSPHERE RESERVES

A biosphere reserve is an international designation of recognition from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) under the *Man and the Biosphere Program* (MAB). The designation signifies that the area is a good example of some of the ways in which conservation objectives can be balanced with development.

The term *biosphere* refers to the association of the designated area with the UNESCO/MAB program and the *reserve* means that there are some already protected sites within the biosphere reserve.

The long-range goal of the MAB is to create a worldwide network of biosphere reserves to include examples of all of the globes main ecological systems with their different patterns of human use and adaptations to them. To receive a designation, each biosphere reserve must have a protected *core* of undisturbed landscape, which can provide baseline data for comparison with nearby areas being managed to meet human needs. Fully functional biosphere reserves perform three main roles:

a) conservation of ecosystems and biota of particular interest
b) establishment of demonstration areas for ecologically sustainable land and resource use
c) provision of logistic support for research, monitoring, education and training related to conservation and sustainable issues

Some biosphere reserves provide sites for the monitoring of long-range transport of atmospheric pollutants, or for "integrated environmental monitoring" to correlate ecosystemic changes with pollutant loading.

As of 1999 the province Ontario has two biosphere reserves. One is the Niagara Escarpment (207,240 ha) and the other is Long Point (27,000ha). These are very large sites and are comprised of a mix of publicly and privately owned land. One objective of the biosphere reserve program is to demonstrate through monitoring and scientific studies, a balance between conservation and development. In that regard, it is not the intent of the biosphere reserve program to exclude all development within the total area designated as a biological reserve, but rather to demonstrate how development can occur and still maintain the ecological functions and integrity of the natural landscape. Each biological reserve includes an existing protected core area.

Planning authorities that have a biosphere reserve within their jurisdiction need not be concerned about protecting all lands within the designated area. These sites have been specifically selected because they have existing protected areas that can be compared to areas that are appropriately developed. In some situations protected buffers around a core-protected area may be considered to ensure the ecological functions of the core area are maintained. This may be accomplished by identifying and protecting any one the seven components of the Natural Heritage Areas and Features Policy of the Planning Act.

For additional information, please contact:

1. Long Point Biosphere Reserve –http://www.cciw.ca/cbra/english/biosphere/br_longpoint/
2. Niagara Escarpment Biosphere Reserve – http://www.cciw.ca/cbra/english/biosphere/br_niagara/intro.html
3. World Biosphere Reserve – http://escarpment.org/biosphere/world.html

CAROLINIAN CANADA SITES

Carolinian Canada is a popular name for the extreme southwest region of Ontario where the Eastern Deciduous Forest of North America has its northernmost limits. The Carolinian Life Zone is one of Canada's most significant landscapes, where a warm climate accounts for the presence of many rare species of plants and animals.

Carolinian Canada is found south of an imaginary line which runs approximately from Grand Bend to Toronto. The climate of this region is the main reason it forms such a unique ecosystem. Often referred to as the 'banana belt' of Canada, this zone boasts the warmest annual temperatures, the longest frost-free seasons and the mildest winters in Ontario. For example, Point Pelee near Windsor averages over 170 frost-free days while Guelph, which is just north of the Carolinian Canada boundary averages only 135 frost-free days per year.

Botanists have mapped the distribution of plants in Ontario, and have established the boundary of the Carolinian Life Zone based on the northern limits of the many species, which are found only within this region of Canada. A glance through either the *Atlas of Rare Vascular Plants of Ontario* or the *Atlas of the Breeding Birds of Ontario* will reveal many species whose range corresponds to Carolinian Canada.

Even though Carolinian Canada is small compared with other Canadian vegetation zones, making up only 1% of Canada's total land area, it boasts a greater number of both flora and fauna species than any other ecosystem in Canada. It is estimated that some 2,200 species of herbaceous plants are found here, including 64 species of ferns, at least 110 species of grasses and over 130 different sedge species. There are 70 species of trees alone. Numerous species of reptiles and amphibians make their home primarily or entirely in this region and close to 400 species of birds have been recorded, representing over half of the species in all of Canada. Several butterflies, such as the Karner Blue and the Frosted Elfin are restricted to this region. Several mammals such as the Badger, the Gray Fox and the Virginia Opossum are primarily restricted to the Carolinian forest. Appendix H provides a list of those animals and plants that are representative of the Carolinian Life Zone of Canada (site regions 6E and 7E).

The most unique feature of the Carolinian Life Zone is the number of rare species found there. The region has one third of the rare, threatened and endangered species found in all of Canada. Sixty five percent of Ontario's rare plants are found in this region and 40% are restricted to the Carolinian Life Zone. Appendix H provides a list of plant and animal species in Ontario and includes a description of their distribution.

The Carolinian Canada Program was established in 1984 as a partnership between government agencies and non-government conservation groups to address the special needs of the region. This program has protected 38 of the most important sites. These sites have been identified as Carolinian Canada sites and are illustrated in Figure A-2. Each site has been selected as a Carolinian Canada site because it possesses an excellent representation of a unique Carolinian life form. There is no legislation or policies specifically aimed at protecting Carolinian Canada sites. Most of these sites are protected however through the Natural Heritage Features and Areas Policy (provincially significant wetlands [PSW's] and Areas of Natural and Scientific Interest [ANSI's]) and by planning authorities through Endangered Species Act (ESA) designations in official plans. Table A-1 provides a list of all 38 Carolinian Canada sites, the municipal jurisdiction in which they are found, the agencies involved in their protection and the level of protection (i.e. PSW's, ANSI's and ESA's).

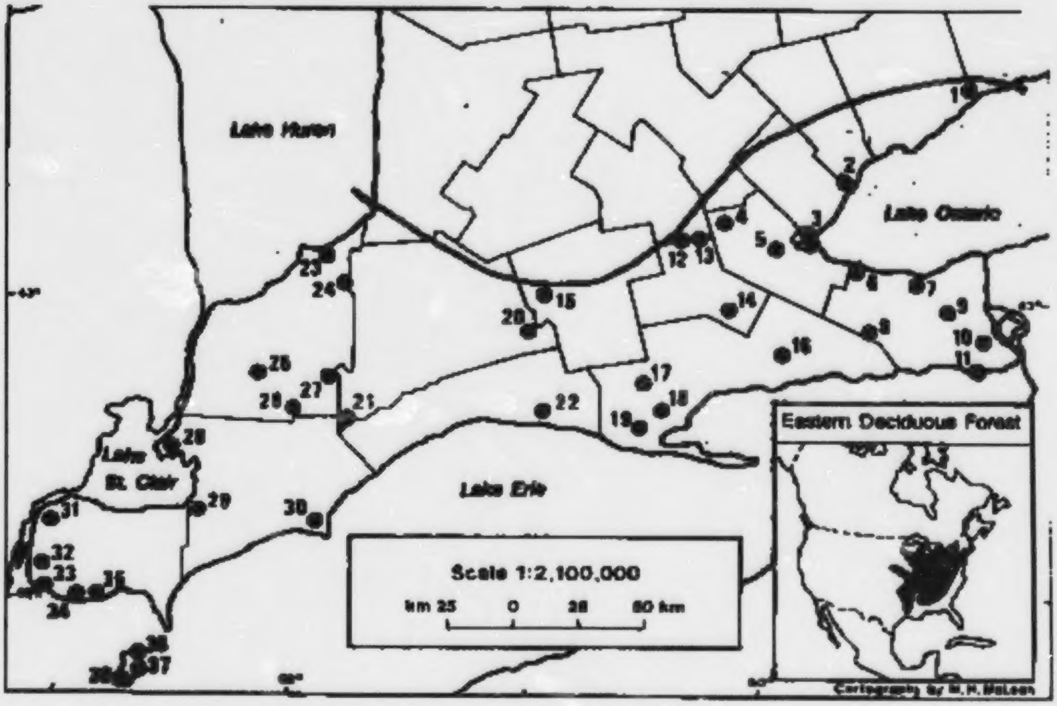


Figure A-2. Carolinian Canada Sites in Ontario.

In addition to the 38 protected Carolinian Canada sites, private landowners have been encouraged as part of the Carolinian Canada program to protect important natural features on their land. Carolinian Canada was the first region in Canada to use a voluntary 'handshake' stewardship agreement as a means of encouraging a commitment to conservation by private landowners. The Natural Heritage Stewardship Award is a plaque given to landowners of Carolinian Canada sites in return for a promise to protect the natural features of their land. As of 1999, 519 landowners that own over 6,000ha in 32 different natural areas have made such agreements.

Planning authorities in the Carolinian Canada Life Zone should be aware the Carolinian Canada sites in their planning area. In most cases the sites already qualify for protection under the Natural Heritage Features and Areas Policy and/or municipal official plan designation. The lands that are under stewardship agreement may or may not be protected. A complete listing of these lands can be found in a report entitled "*Report on Landowner Contact Information for the Carolinian Canada, Niagara Escarpment and Wetland Habitat Agreement Programs*" by van Hemessen, D. et al 1995.

For more information on Carolinian Canada please contact:

1. http://www.carolinian.org
2. Allen, G.M., P.F.J. Eagles, S.D. Price (editors). 1990. Conserving Carolinian Canada. University of Waterloo Press, Ontario.
3. Beechey, T.J. and P.F.J. Eagles. 1985. Critical Unprotected Natural Areas in the Carolinian Life Zone of Canada.
4. Lussier, C. and P. Lawrence. 1999. Natural Heritage Planning in the Carolinian Canada Zone – Final Report. Natural Resources Centre, University of Waterloo. Technical Paper 15.
5. Van Hemessen, D., L. O'Grady and R. Martin. 1995. Report on Landowner Contact Information for the Carolinian Canada, Niagara Escarpment and Wetland Habitat Agreement Programs. Draft. Ontario Ministry of Natural Resources.

Western Hemisphere Shorebird Reserve Network

The Western Hemisphere Shorebird Reserve Network (WHSRN) is an international conservation initiative designed to protect key habitats and resources used by shorebirds throughout their migration ranges. Many species of shorebirds depend on a chain of critically important sites to complete their annual migrations, and for conservation to be successful, all the links in the chain need to be preserved. Fifty-four potential and/or declared WHSRN sites for shorebirds have been identified in Canada (Morrison *et al.* 1985).

Four categories of WHSRN sites are recognised:

> Hemispheric sites: support at least 500,000 shorebirds annually, or 30% of a species' flyway population. Hemispheric Sites are intended to include areas supporting major concentrations of shorebirds, with daily total reaching about 50,000 birds during migration.
>
> International sites: support at least 100,000 shorebirds annually, or 15% of a species' flyway population.
>
> Regional sites: support at least 20,000 shorebirds annually, or 5% of a species' flyway population.
>
> Endangered Species sites: are critical to the survival of endangered species (no minimum number of birds is required).

The most important habitats for shorebirds in Ontario are found along the coasts of James Bay and Hudson Bay (Figure A-3). Habitats in the south of the province are generally smaller in area and are located along the shores of the Great Lakes or of other lakes and rivers. Many of these are affected by fluctuating water levels and thus may vary in importance from year to year, depending on the amount and quality of habitat available. Most are affected by developments, pollution or by increasing recreational use by humans. Few of the numerous lakes in northern and central Ontario are thought to have habitats suitable for shorebirds.

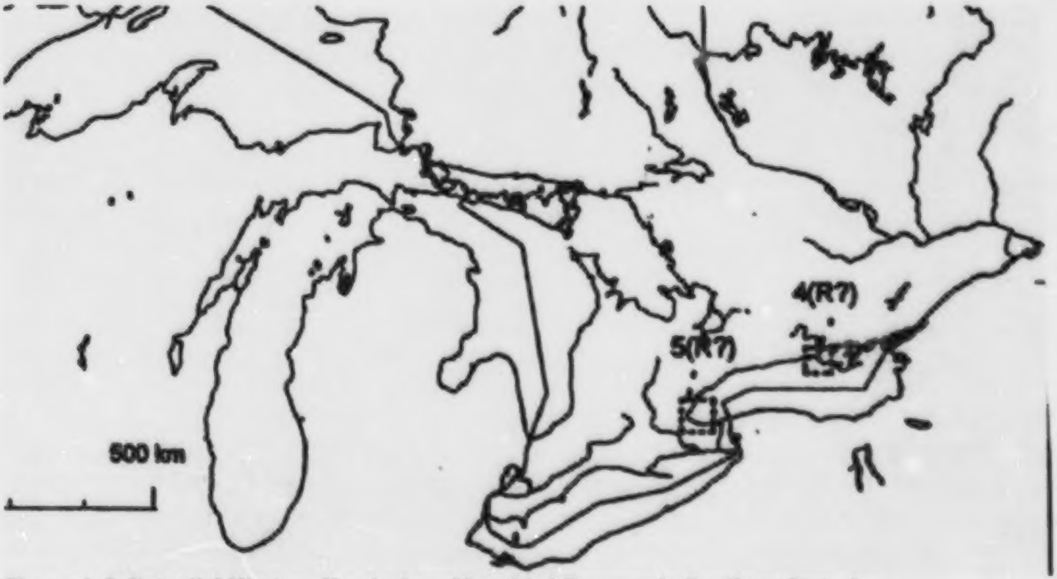


Figure A-3. Potential Western Hemisphere Shorebird Reserves in Southern Ontario.

Presqu'ille Provincial Park (Regional ?)

The long beach and point at this site provide sandy and muddy habitats that can be heavily used by shorebirds, especially when beds of washed up algae accumulate along the lakeshore. Numbers occurring in the park generally range into the hundreds for the more common species (McRae 1982, 1986), although large concentrations can occur when birds are forced down by poor weather. High counts include 5,950 and 7,000 Dunlin in 1983 and 1985, respectively (Morrison *et al.* 1985). McRae (1986) reported that as many as 20,000 shorebirds have been found during northward migration after the birds have been grounded by adverse whether and considers that this many may use the area during the course of a year.

Western End of Lake Ontario (Regional ?)

A complex of sites around Hamilton, including Dundas Marsh, the Windermere Basin, the Smithville Sewage Ponds, and sections of the lakeshore have been estimated to support over 20,000 shorebirds during the course of the year (Clarke 1988, ISS counts), though numbers at the individual sites do not reach levels to satisfy WHSRN criteria. The heavily polluted nature of parts of this area makes its designation as a reserve questionable.

Reference:

Clarke, M.F.G. 1988. A proposal of the Western End of Lake Ontario as a Regional Reserve in the Western Hemisphere Shorebird Reserve Network. Unpubl. Rep. 14 pp.

McRae, R.D. 1982. Birds of Presqu'ile, Ontario. 74 pp. Ontario Ministry of Natural Resources.

McRae, R.D. 1986. Presqu'ile Provincial Park, Ontario, Canada. Site Guide. American Bird 40: 35-36.

Morrison, R.I.G., R.W. Butler, G.W. Beyerbergen, H.L. Dickson, A. Bourget, P.W. Hicklin, J.P. Goossen, R.K. Ross, and C.L. Gratto-Trevor. 1995. Potential Western Hemisphere Shorebird Reserve Network Sites for Shorebirds in Canada: Second Edition 1995. Canadian Wildlife Service Technical Report Series 227, 147 pp. Canadian Wildlife Service, Headquarters, Ottawa.

Table A-1. List of Carolinian Canada Sites in Ontario.

	Site Name	Jurisdiction	Agencies	NGO's	Wetland	ANSI	ESA
1	Rouge River Valley	Toronto	Rouge Park, MNR, MTRCA	Friends of the Rouge	2	*	*
2	Iroquois Shoreline Woods	Oakville/Halton	Town of Oakville, MNR			*	*
3	Sassafras Woods	Halton	Halton RCA, MNR		1	*	*
4	Beverly Swamp	Hamilton-Wentworth	GRCA,HRCA, HamRCA, MNR			*	*
5	Dundas Valley	Hamilton-Wentworth	HamRCA, MNR		5	*	*
6	Grimbsy-Winona Escarpment and Beamer Valley	Niagara	NPCA, HamRCA, MNR, NEC			*	
7	Jordan Escarpment Valley	Niagara	NPCA, MNR, NEC				
8	Caistor-Canborough Slough Forest	Niagara	NPCA, MNR		2	*	
9	Fonthill Sandhill Valley	Niagara	NPCA, MNR, NEC			*	
10	Willoughby Clay Plain	Niagara	NPCA, MNR		1	*	
11	Point Albino Peninsula Sandland Forest	Niagara	NPCA, MNR		2	*	
12	Sudden Bog	Waterloo/Brant	GRCA, MNR		3	*	
13	Grand River Valley Forests and Spottiswood Lakes	Waterloo/Brant	GRCA, MNR		1	*	
14	Six Nations I.R. Forests	I.R.	Six Nations Eco Centre				
15	Embro Upland Forest	Oxford	UTRCA, MNR		7	*	
16	Oriskany Sandstone and Woodlands	Haldimand-Norfolk	LPRCA, MNR		2	*	*
17	Delphi Big Creek Valley	Haldimand-Norfolk	LPRCA, MNR	NFN	1	*	*
18	St. Williams Dwarf Oak Forest	Haldimand-Norfolk	MNR	NFN			*
19	Big Creek Valley - South Walsingham Sand Ridges	Haldimand-Norfolk	LPRCA, MNR	NFN	1&2	*	*
20	Dorchester Swamp	Middlesex	UTRCA, MNR	LAG	2	*	
21	Skunk's Misery	Kent/Middlesex	LTVCA, StCRCA, MNR		2	*	
22	Catfish Creek Slope and Floodplain Forest	Elgin	CCCA, MNR		4		
23	Port Franks Wetlands and Forested Dunes	Lambton	ABCA, MNR	LWI	1	*	*
24	Ausable River Valley	Lambton	ABCA, MNR	LWI		*	*
25	Plum Creek Upland Woodlots	Lambton	StCRCA, MNR	LWI	4	*	*
26	Shetland Kentucky Coffee-tree Woods	Lambton	StCRCA, MNR	LWI			*
27	Sydenham River Corridor	Lambton	StCRCA, MNR	LWI			*
28	Walpole Island I.R.	I.R.			1		*
29	Lake St. Clair Marshes	Kent	LTVCA, StCRCA, MNR		1	*	
30	Sinclair's Marsh	Kent	LTVCA, MNR			*	
31	Ojibway Prairie Remnants	Essex	City of Windsor, MNR	OTPSA		*	*
32	Canard River Kentucky Coffee-tree Woods	Essex	ERCA, MNR				*
33	Big Creek Marsh	Essex	ERCA, MNR		1	*	*
34	Oxley Poison Sumac Swamp	Essex	ERCA, MNR		3	*	*
35	Cedar Creek	Essex	ERCA, MNR		3	*	*
36	Middle Point Woods	Essex	ERCA, MNR			*	*
37	Stone Road Alvar	Essex	ERCA, MNR	FON		*	*
38	Middle Island	Essex	ERCA, MNR			*	*

APPENDIX B

Ecological Considerations Underlying Natural Heritage Planning

Effective implementation of the Natural Heritage Policy requires an understanding of some of the key concepts and ecological factors underlying natural heritage system planning. The text that follows is intended to introduce some of these concepts and factors. This material will help address three fundamental questions in natural heritage system planning:

1. How do surrounding landscapes affect natural heritage protection needs within a planning area?
2. How much natural area should be protected within a planning area?
3. Which are the most important areas to protect within a planning area?

In areas where few natural heritage features and areas remain, or where they are degraded or fragmented, the information provided in this appendix will help determine where improvements (i.e., restoration efforts) would be most effective. This is consistent with Policy 2.3.4 of the Provincial Policy Statement.

Maintaining Natural Heritage Systems

The reasons why natural heritage features and areas need to be protected can be distilled into two key goals:

- to help conserve biodiversity
- to ensure that ecosystems/landscapes are both healthy and functional

Achieving these goals is essential to human survival and to ensure that society can continue to derive benefits from natural heritage systems.

Biodiversity

Biodiversity, or biological diversity, is a concept that expresses the variability of life on earth, and the diversity of ecological processes and dependencies that are characteristic of ecosystems (Riley and Mohr 1994). The United Nations Convention on Biodiversity, which was signed by Canada in 1992, defines biodiversity as follows:

> *Biodiversity is the variability among organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.*

Biodiversity is commonly measured at several levels. Noss and Cooperrider (1994), Decker *et al.* (1991) and Riley and Mohr (1994) describe four-level systems with the following components: genetic; species/population; community/ecosystem; and landscape/region.

- **Genetic variability** refers to the genetic differences that occur within a particular species that can be passed along to offspring. It is the set of traits that allow species to adapt to change over time.

- **Species diversity** refers to the variety of species that occur within a particular area. Collectively, all of the individuals of a particular species in a particular area form a **population**. Management efforts and conservation goals are often directed at populations, or the habitats necessary to sustain them.

- **Community diversity** refers to the associations of species within an area. These associations, also called biological communities, are the living components of **ecosystems**. Ecosystems are composed of two elements: (1) the biological communities within an area, and (2) the physical environment within the area.

In many cases, the most effective way to manage or conserve species or populations is to manage or conserve the communities/ecosystems within which they are found.

- **Landscape/regional diversity** refers to the variety of ecosystems and communities that can be found within the landscape. At this scale, the size, arrangement and degree of interconnection between ecosystems/communities are particularly important.

These four biodiversity levels are interdependent. Conserving the biodiversity within a planning area requires that each of these levels be considered. Management/protection actions are often most appropriately undertaken (effectively) at the community/ecosystem level. Planning for natural heritage values, however, often benefits from considerations at the landscape level.

The conservation of species and ecosystems is fundamental to the protection of the province's, and the planet's, biodiversity. The need to protect biodiversity is recognised globally. Canada, with the support of provincial and territorial governments, acknowledged this by signing the United Nations Convention on Biodiversity in 1993. Since that time, the Canadian Biodiversity Strategy has been developed, and all provinces have made a commitment to implement it within their respective jurisdictions.

Healthy/Functional Ecosystems/Landscapes

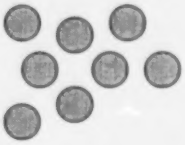
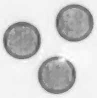
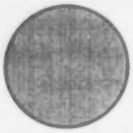
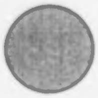
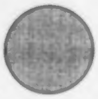
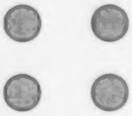
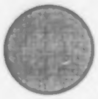
The maintenance of biodiversity, as described above, is of immense importance. However, planning for biodiversity, alone, will not ensure the proper functioning of the underlying ecosystems and landscapes. Additional measures are required in order to ensure the health and proper functioning of the ecosystems in which we live. These measures involve conserving more of the landscape than is required to meet biodiversity objectives alone. Maintaining the health and functionality of ecosystems and landscapes is essential if municipalities are to continue to derive benefits from natural heritage systems.

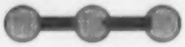
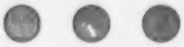
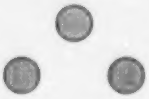
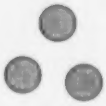
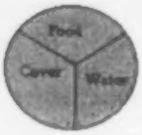
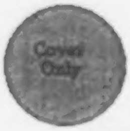
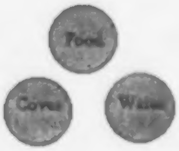
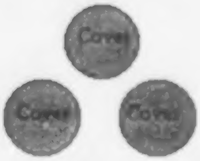
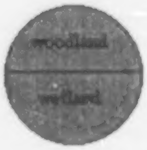
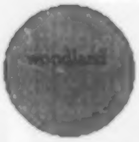
KEY CONCEPTS IN NATURAL HERITAGE SYSTEM PLANNING

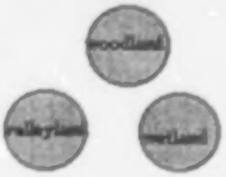
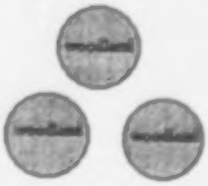
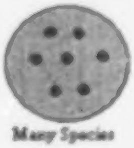
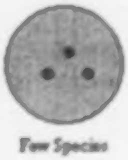
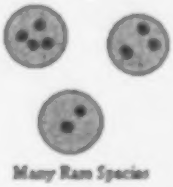
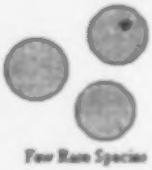
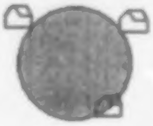
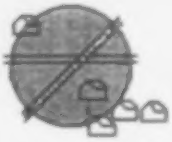
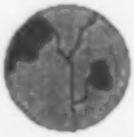
Important steps in natural heritage system planning are to identify the natural areas within the planning area and to assess their ecological importance. Each candidate site can be evaluated using several criteria since natural heritage features and areas provide many values. However, it is often necessary to rely on a limited number of criteria due to constraints such as budget, time or information.

The following is a discussion of some ecological factors that are commonly incorporated into various natural heritage areas, evaluation procedures. These factors are based largely upon Crins (1996), Decker *et al.* (1991), Noss and Cooperrider (1994), Phillips (1996), Primack (1993), Riley and Mohr (1994) and Smith and Theberge (1986). Some are illustrated in Figure 1.

Figure B-1: Relative Habitat Value In Relation to Patch Size, Shape, Arrangement and Function

	Rule	Good	Poor
A	Natural heritage systems that include the full range of habitat-landform types are better than those that contain fewer habitat-landform types.		
B	Large patches are usually better than smaller patches.		
C	Large patches are usually better than clusters of smaller patches with the same total area.		
D	A compact patch with a limited amount of edge is better than a narrow patch with more edge.		

	Rule	Good	Poor
E	Connected patches are usually better than unconnected patches.		
F	Closely clustered patches are usually better than less closely clustered patches.		
G	Clustered patches are usually better than "in-line" patches of the same total area.		
H	Patches that meet several of the habitat needs of one or more species are more valuable than patches that meet fewer habitat needs.		
I	Clusters of patches that collectively meet several of the habitat needs of one or more species are more valuable than clusters of patches that meet fewer habitat needs.		
J	Natural areas that contain more than one natural heritage feature or area may be more valuable than patches with a single natural heritage feature or area.		

Rule	Good	Poor
K Clusters of patches that contain several types of natural heritage features or areas are more valuable than areas with clusters of patches composed of a single type of natural heritage area.		
L Patches that contain a high diversity of species are usually more valuable than patches that contain fewer species.		
M Patches that contain rare species are generally more valuable than patches without rare species.		
N Patches that are relatively unaffected by human use are more valuable than more disturbed patches.		
O Patches that contain water-bodies are generally more important than those that do not.		

Representation/Distribution

A fundamental step in natural heritage system planning is to ensure that the full range of natural features that occur in an area, including both rare and common features, are protected. The rationale for doing so is to ensure that the full range of species and habitats within those features are protected, thus contributing to the preservation of biodiversity at the species and community levels. Further, species, communities and ecosystems that are well distributed across their native range are less susceptible to decline than species, communities and ecosystems confined to small portions of their historic range (see Figure B -1A).

Representation is normally assessed at the site district level. It forms the cornerstone of the identification and evaluation procedure for the province's ANSI program. Planning authorities can make a significant contribution to the protection of the full range of natural features and species that occur in an area by ensuring the protection of any significant ANSIs that have been identified. Representative areas provide a logical foundation around which a planning area's natural heritage system can be designed.

Rule #1. ***Ensure that the full range of habitat/landform types that occur in an area are protected.***

Size

Large patches of natural areas are generally more valuable than smaller patches (see Figure B - 1B). Similarly, a single large patch is generally better than several smaller patches of the same total area (see Figure B - 1C). There are several reasons.

1. Larger patches tend to contribute more to biodiversity than smaller patches of similar habitat (Phillips 1996). This is because large areas tend to contain a broader diversity of features and habitats than smaller areas. In doing so, larger areas generally

   - contribute more to the diversity of features in an ecoregion/ecodistrict than smaller areas, and

   - meet more of the habitat requirements of a greater number of species than smaller areas. One of the reasons for this is that large areas generally provide more "interior" (i.e., contiguous, relatively undisturbed, unfragmented) habitat than smaller areas. "Interior" habitat is critical to the survival of many species, particularly "forest-interior" birds.

2. Larger natural areas are generally more resilient to the impacts of human disturbance. For example, many of the smaller woodlots in southern Ontario contain a large number of invasive exotic plant species that can or have displaced native species. Larger natural areas are more likely to have internal ecosystem functions like nutrient cycles and food webs intact and to be large enough to permit different successional stages to co-exist on the site.

3. Large areas are capable of supporting larger populations of different species than smaller blocks of similar habitat (Noss and Cooperrider 1994). Large populations tend to be more resilient to human-induced and other disturbances than smaller populations.

4. Cumulatively, small areas can provide significant benefits to the overall landscape by reducing erosion, providing wildlife habitat, etc. These effects, in turn, benefit other critical habitats.

Are small areas worth keeping? Many small natural areas should be protected. There are several reasons why such areas can be important.

1. Small areas, particularly if they provide unique habitat conditions, can support rare plant or animal species found nowhere else in the area. Such small areas are particularly important to species with low mobility (Riley and Mohr 1994).

2. Small areas, particularly if interspersed amongst larger habitat patches, can provide important temporary refuges better enabling more mobile species to move between larger patches.

3. As well, in highly diverse landscapes, the protection of several smaller habitat patches can provide better representation of a wider range of habitats than a single larger habitat patch (Peterson and Peterson 1991; Riley and Mohr 1994).

Rule 2. ***Large patches are generally more valuable than small patches.***
Rule 3. ***A single large patch is generally better than clusters of smaller patches with the same total area.***

Shape

The shape of natural heritage areas affects their value as wildlife habitat and their resilience to disturbance effects. Round or block-shaped patches contain less "edge" per unit of area than long, narrow patches (see Figure 1D). Edge refers to the area where different habitats (or habitat conditions) meet. For examples, edges occur where woodlots meet open fields, where uplands meet lowlands, along shorelines and fencerows, at the interface between deep water and shallow water, etc. Many species of wildlife (e.g., deer, and grouse) need "edge" habitats.

Other species, however, require large contiguous blocks of habitat well away from habitat edges. These areas are often termed interior habitats. Some interior habitat dwelling species will only use an area if it is 100 metres or more away from an edge.

In parts of Ontario, particularly in the south, the fragmentation of natural habitats has created an abundance of edge habitat while, at the same time, reducing the availability of interior habitats. Consequently, in southern Ontario, round or block-shaped areas would normally be higher priority areas for protection than long, narrow habitats of similar composition. In some situations, however, narrow habitat patches may have special value in ensuring the connection of other important patches.

Rule #4. ***Patch shapes that minimise "edge" are generally preferred over patches with more edge.***

Fragmentation/Connectedness

An obvious impact of development on natural areas is fragmentation. Fragmentation refers to the process by which large, interconnected natural areas are converted to a series of smaller, often isolated natural areas. In much of southern Ontario, the landscape has become highly fragmented. In other parts of the province, particularly some northern areas, fragmentation has been less severe.

Rule #5. ***Avoid fragmenting natural areas.***

As indicated above, smaller natural areas generally meet the needs of fewer species of wildlife than larger areas. This results from the fact that the remaining areas may simply be too small to meet the habitat needs of the species that once used the area, and the fact that smaller areas, on average, will contain a lower diversity of habitat conditions than larger areas. Small areas are also more easily damaged by disturbance effects and are less likely to have their functional processes intact.

Another potentially serious consequence of habitat fragmentation is the physical separation, or isolation, of one habitat patch from another. If separation distances are large enough, the movement of plants (i.e., their seeds) and animals from one patch to another can be hindered or prevented. The resultant isolation of one wildlife population from another can:

- lead to inbreeding which, over time, may reduce the ability of the population to survive; and
- prevent the recolonization of an area after local extinction

As a general rule, then, interconnected patches of habitat are better than isolated patches (Figure 1E). However, there are exceptions. Some habitats and species that are found in isolated areas are better protected when they are isolated from other areas. Other habitats (and species) do benefit from connections, but only if the connections between them have the appropriate characteristics. For example, very narrow connections, such as fencerows, which link one woodlot to another, can provide predators with an extremely effective hunting environment, which can put prey species at risk. The key is to plan for connections of larger woodlots or a network of smaller areas. In doing so, the widest possible connections should be protected. Where connections are very narrow, planning authorities should consider improving (i.e., widening) them. This is consistent with Section 2.3.3 of the Natural Heritage Features and Areas Policy.

Rule #6. ***Connected patches are usually better than unconnected patches.***

Arrangement/Proximity

Blocks of habitats that are arranged close together are usually better than blocks of habitat that are located further apart. There are two reasons for this. First, wildlife is able to move more safely between closely spaced habitat patches than between patches located farther apart. Secondly, closely spaced patches are more likely to have important functional (i.e., hydrological or biochemical) linkages than more distant patches (see Figures B - 1F and G).

Rule #7. ***Clustered patches are usually better than "in-line" patches of the same total area.***
Rule #8. ***Closely clustered patches are usually better than more distant patches.***

Habitat Diversity/Complexity

Natural areas (or clusters of areas) that span a range of topographic, soil and moisture conditions, tend to contain a wider variety of plant species and plant communities, and may also support a greater diversity of ecological processes, than similar areas that occupy a narrower range of topographic, soil and moisture conditions. Areas with a high diversity of plant species and plant communities will generally support a correspondingly high diversity of animal species and communities. For example, a natural area that includes both wetland (lowland) and upland components will provide a greater range of habitat conditions for wildlife than either habitat type alone. Similarly, a wetland that contains each of the four wetland types (marsh, swamp, bog and fen) will provide more habitat diversity than a wetland composed entirely of marsh (see Figures B - 1H-K). A variety of techniques are available for assessing habitat and/or vegetation community diversity.

Rule #9. ***Patches, or clusters of patches, that meet several of the habitat needs of one or several species are more valuable than patches that meet fewer habitat needs.***
Rule #10. ***Patches or clusters of patches, that contain more than one natural heritage feature or area may be more valuable than patches with a single natural heritage feature or area.***

Species Diversity

Areas that contain a high diversity of plant and animal species are generally more important than areas that contain a lower diversity of species (Figure B - 1L). In some situations, however, areas that contain a relatively low diversity of plant and/or animal species are important and should be protected, for example, where they provide habitat for an endangered or threatened species, or some other species of particular interest or conservation concern.

Species richness assessments can be undertaken as a means of comparing species diversity between sites. Species lists compiled in OMNR's Site District reports or in individual site inventory reports may be useful in conducting such assessments. It is essential to assess diversity relative to each candidate area's size since the number of species will vary with size.

Rule #11. ***Patches that contain a high diversity of plant and animal species are generally more valuable than patches with a lower diversity of plant and animal species.***

Species Rarity

In general, habitats that contain rare species are more valuable than habitats that do not contain such species (Figure B - 1M). Rarity is a relative term and can be described in 5 different ways:
(1) species that are scarce, but occur over a wide geographical area
(2) species that only inhabit one place
(3) species that are geographically separated from their main range
(4) species that are at the edge of their geographical range
(5) declining species that were once more abundant and/or widespread but are now depleted

Assessments of rarity are often expressed as the number of rare species or features in an area. Lists of species and features considered rare at one or several scales (e.g., local, regional, or national), such as those provided in OMNR's Site District reports or in NHIC's status lists, will be useful in evaluating candidate natural areas for significance. Specifically, the occurrence of rare species may add to the significance of a particular feature or area. However, it is important to realise that rare species are not necessarily endangered or threatened species, as defined in the policy.

Rule #12. ***Patches that contain rare species are generally more valuable than patches that do not contain such species.***

Naturalness/Disturbance

Relatively undisturbed natural areas are generally more desirable than highly altered areas (Figure B - 1N). The manner in which the adjacent lands surrounding a protected natural area are used and/or developed can markedly affect the viability of the natural area or the features within it. The most common rationale for using naturalness as a criterion is that undisturbed, natural areas provide the best source of baseline information to compare with other modified areas. By studying how undisturbed ecosystems function, a better understanding of how human impacts modify ecosystems can be gained. These areas will also provide important clues for restoring ecosystems that have been modified.

Methods used to evaluate naturalness vary depending on the ecosystem, information available and the level of human disturbance. For example, measuring the relative absence of exotic species could assess the naturalness of a valley-land, cattle-grazing or man-made structures such as riprap, dams, roads or buildings.

Rule #13. ***Patches that are relatively unaffected by human disturbance are generally more valuable than patches that are more highly disturbed.***

Hydrologic and Related Values

In many areas, water bodies including wetlands, often represent a relatively small percentage of the total land area, yet they can be disproportionately more valuable than other areas (Figure B - 1O) for several reasons:

- there is a large number of aquatic or riparian (moist-area dependent) plant and animal species that depend upon water bodies or wetlands to fulfil their habitat needs
- there is a large number of other animal species that require access to water bodies for all or part of their life cycle in order to survive
- there is a large number of species that use water bodies, especially streams, as travel or migration corridors
- they are critical to the maintenance of nutrient and other bio-chemical nutrient cycling processes upon which all species depend
- they are integral to the hydrologic functioning of the watershed within which they are located

Water bodies, wetlands, and other areas of significant hydrological importance (i.e., headwaters, recharge areas, discharge areas, etc.) should be protected.

> ***Rule #14.*** ***Waterbodies, wetlands and other areas (e.g. seeps, recharge/discharge areas) are very important and should be protected wherever possible.***

References Cited

Crins, W.J. 1996.Life science gap analysis for site district 4E-3. Ontario Ministry of Natural Resources, Lands and Natural Heritage Branch, Peterborough, Ontario. 251 p.

Decker, D.J., M.E.. Krasny, G.R. Goff, C.R. Smith and D.W. Gross, editors. 1991. Challenges in the conservation of biological reserves - a practitioner's guide. Westview Press. 402 pp.

Noss, R.F. and A.Y. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. Island Press, Washington, DC. 416 p.

Peterson, E.B. and N.M. Peterson. 1991. A first approximation of principles and criteria to make Canada's protected areas system representative of the nation's ecological diversity. Western Ecological Services Limited, Victoria, British Columbia. Report for the Canadian Council on Ecological Areas. 47 p + appendices.

Phillips, M.E.J. 1996. Natural heritage protection in southern Ontario. Terrestrial ecosystem assessment and management: the case of forested environments. M.Sc. Research Paper. University School of Rural Planning and Development, University of Guelph, Guelph, Ontario. 77 p, Appendices.

Primack, R.B. 1993. Essentials of conservation biology. Sinauer Publishing. 564 p.

Riley, J.L. and P. Mohr. 1994. The natural heritage of southern Ontario's settled landscapes. A review of conservation and restoration ecology for land-use and landscape planning. Ontario Ministry of Natural Resources, Southern Region, Aurora, Science and Technology Transfer, Technical Report TR-001. 78pp.

Smith, P.G.R and J.A.Theberge 1986. A review of criteria for evaluating natural areas. Environmental Management 10: 715-734

APPENDIX C

A List of Area Sensitive Species and Key References

A number of wildlife species require large areas of suitable habitat in order to sustain their population numbers. These species, referred to as *area sensitive species*, are identified in **Appendix G**. Area sensitive species identified in **Appendix G** are listed below. A short list of references to scientific literature that are particular to each species is also provided.

The reference list provided in this section is by no means complete. These references are meant to assist the reader in doing a further search of the scientific literature for information about these particular wildlife species and the habitats in which they live.

There are two parts to this appendix. Table 1 has been arranged by Class. A short list of references associated with each species is provided in this table. These references are listed in the reference section that follows Table 1.

The reference section also is arranged by Family and alphabetically by author. This section includes **additional** references other than those listed in Table 1. The Birds section is subdivided into seven subsections:

1) General
2) Effects of Habitat Fragmentation
3) Waterfowl and Other Marsh Birds
4) Birds Associated with Grasslands and Old Fields
5) Birds Associated with Forests
6) Woodpeckers
7) Raptors

While the majority of bird references listed in Table 1 will be found in subsections 3-7, if an author's name can not be found in these subsections, check the subsection on effects of habitat fragmentation, particularly for grassland or forest species.

Table 1: A list of area sensitive wildlife species and associated references.

SPECIES	REFERENCES
Amphibians Bullfrog *Rana catesbeiana*	Cebek (1986); Coleman (1995); Ontario Ministry of Natural Resources (1994)
Reptiles Spotted Turtle *Clemmys guttata*	Chippindale (1984); Chippindale (1985); Cook *et al.* (1980); Ernst (1967); Ernst (1976); Lovich (1988); Litzgus (1996); Haxton (1997); Haxton and Berrill (1999)
Wood Turtle *Clemmys insculpta*	Obbard (1985); Quinn and Tate (1991); Brooks *et al.* (1992); Foscarini (1994)
Common Map Turtle *Graptemys geographica*	Graham and Graham (1992); Daigle *et al.* (1994)
Eastern Spiny Softshell *Apalone spinifera spinifera*	Campbell and Donaldson (1980)
Black Rat Snake *Elaphe obseleta obseleta*	Fitch (1963); Fitch and Shirer (1971); Parsons (1977); Stickel and Cope (1947)

Eastern Hognose Snake *Heterodon platirhinos*	Platt (1969)

Mammals Northern Flying Squirrel *Glaucomys sabrinus*	Cowan (1936)
Southern Flying Squirrel *Glaucomys volans*	Sollberger (1940); Sollberger (1943)
Marten *Martes americana*	Bushkirk and Powell (1994); De Vos (1952); Francis and Stephenson (1972); Koehler *et al.* (1975); Thompson (1991); Watt *et al.* (1996); Wynne and Sherburne (1984)
Fisher *Martes pennanti*	Bushkirk and Powell (1994); De Vos (1952) ; Kilpatrcik and Rego (1994); Garent and Crete (1997)
Lynx *Lynx canadensis*	Quinn (1984)
Moose *Alces alces*	Ontario Ministry of Natural Resources (1984); Ontario Ministry of Natural Resources (1990)
Woodland Caribou *Rangifer tarandus*	Bergerud (1974); Calef (1981); Cringan (1957); Skoog (1968);
Birds Red-necked Grebe *Podiceps grisegena*	Cringan (1957); De Smet (1982)
American Bittern *Botaurus lentiginosus*	Gibbs *et al.* (1992)
Least Bittern *Ixobrychus exilis*	Gibbs *et al.* (1992)
Northern Pintail *Anas acuta*	Austin and Miller (1995) Smith (1971)
Canvasback *Aythya valisineria*	Bergman (1973); Dennis and Chandler (1974); Dennis *et al.* (1984); Korschgen *et al.* (1984)
Redhead *Aythya americana*	Dennis and Chandler (1974); Dennis *et al.* (1984)
Common Goldeneye *Bucephala clangula*	Campbell and Milne (1977); Eadie *et al.* (1995); Hume (1976); Mathews (1982); Ross (1984)
Common Merganser *Mergus merganser*	Mathews (1982); Ross (1984)
Red-breasted Merganser *Mergus serrator*	Ross (1984)
Bald Eagle *Haliaeetus leucocephalus*	Broley (1952); McKeating (1985)
Northern Harrier *Circus cyaneus*	Bent (1961)

SPECIES	REFERENCES
Sharp-shinned Hawk *Accipiter striatus*	Bent (1961)
Cooper's Hawk *Accipiter cooperii*	Bent (1961); Penak (1983); Rosenfield and Bielefeldt (1993)
Northern Goshawk *Accipiter gentilis*	Bent (1961); Squire and Reynolds (1997)
Red-shouldered Hawk *Buteo lineatus*	Bent (1961); Bryant (1986); Crocoll (1994); Risley (1982); Sharp *et al.* (1982)
Broad-winged Hawk *Buteo platypterus*	Bent (1961); Goodrich *et al.* (1996)
Sharp-tailed Grouse *Tympanuchus phasianellus*	Connelly *et al.* (1998); Olsen (1959); Snyder (1935)
Yellow Rail *Coturnicops noveboracensis*	Anderson (1977); Bart *et al.* (1984); Brookhout (1995)
King Rail *Rallus elegans*	Meanley (1969); Meanley (1992)
American Coot *Fulica americana*	Friley *et al.* (1938)
Sandhill Crane *Grus canadensis*	Hall-Armstrong and Armstrong (1982); Lumsden (1971); Riley (1982); Tacha *et al.* (1992); Tebbel and Ankney (1982)
Upland Sandpiper *Bartramia longicauda*	Swanson (1996)
Forster's Tern *Sterna forsteri*	Bergman *et al.* (1970)
Black Tern *Chlidonias niger*	Bergman *et al.* (1970); Dunn 1979
Barred Owl *Strix varia*	Bent (1961); Eckert (1974)
Great Gray Owl *Strix nebulosa*	Bent (1961); Eckert (1974); Nero (1979); Nero and Taylor (1980)
Short-eared Owl *Asio flammeus*	Bent (1961); Eckert (1974); Holt and Leasure (1996)
Boreal Owl *Aegolis funereus*	Bent (1961); Bondrup-Nielsen (1978); Eckert (1974)
Whip-poor-will *Caprimulgus vociferus*	Cadman *et al.* (1987)

SPECIES	REFERENCES
Hairy Woodpecker *Picoides villosus*	Bent (1939)
Three-toed Woodpecker *Picoides tridactylus*	Bent (1939)
Black-backed Woodpecker *Picoides arcticus*	Bent (1939)
Pileated Woodpecker *Dryocopus pileatus*	Bent (1939); Bull and Holthausen (1993); Bull *et al.* (1992); Freemark and Collins (1992); Kirk and Naylor (1996); Naylor *et al.* (1996)
Acadian Flycatcher *Empidonax virescens*	Christy (1942)
Least Flycatcher *Empidonax minimus*	Breckenridge (1956); Davis (1959)
Tufted Titmouse *Parus bicolor*	Grubb and Pravosudov (1994); Woodford (1962)
Red-breasted Nuthatch *Sitta canadensis*	Bent (1964)
White-breasted Nuthatch *Sitta carolinensis*	Bent (1964); Pravosudov and Grubb (1993)
Brown Creeper *Certhia americana*	Bent (1964)
Winter Wren *Troglodytes troglodytes*	Bent (1964)
Blue-gray Gnatcatcher *Polioptila caerulea*	Ellison (1992)
Veery *Catharus fuscescens*	Bertin (1977); Moskoff (1995)
Hermit Thrush *Catharus guttatus*	Hoover *et al.* (1995); Jones and Donovan (1996)
Loggerhead Shrike *Lanius ludovicianus*	Cadman (1986); Campbell (1975); Yosef (1996)
Blue-headed Vireo *Vireo solitarius*	James (1998)
Yellow-throated Vireo *Vireo flavifrons*	Rodewald and James (1996)
Northern Parula *Parula americana*	Bent (1953); Moldenhauer and Regelski (1996)
Magnolia Warbler *Dendroica magnolia*	Bent (1953); Hall (1994); Sutherland (1986)

SPECIES	REFERENCES
Black-throated Blue Warbler *Dendroica caerulescens*	Bent (1953); Holmes (1994)
Black-throated Green Warbler *Dendroica virens*	Bent (1953); Collins (1983); Morse (1993)
Blackburnian Warbler *Dendroica fusca*	Bent (1953); Lawrence (1953); Morse (1994)
Pine Warbler *Dendroica pinus*	Bent (1953)
Cerulean Warbler *Dendroica cerulea*	Bent (1953); Dunn and Garrett (1997); Oliarnyk and Robertson (1996)
Black-and-white Warbler *Mniotilta varia*	Bent (1953); Kricher (1995)
American Redstart *Setophaga ruticilla*	Bent (1953); Sidel and Whitmore (1982)
Prothonotary Warbler *Protonotaria citrea*	Bent (1953); Flaspohler (1996); McCracken (1981)
Ovenbird *Seiurus aurocapillus*	Bent (1953); Burke and Nol (1998); Porneluzi *et al.* (1993); Villard *et al.* (1993)
Canada Warbler *Wilsonia canadensis*	Bent (1953)
Scarlet Tanager *Piranga olivacea*	Bent (1958)
Savannah Sparrow *Passerculus sandwichensis*	Bedard and LaPointe (1984); Dixon (1972); Dixon (1978); Potter (1972); Swanson (1996); Wiens (1973)
Grasshopper Sparrow *Ammodramus savannarum*	Swanson (1996); Whitmore (1981); Wiens (1973)

REFERENCES

AMPHIBIANS AND REPTILES

BROOKS, R.J., C.M. SHILTON, G.P. BROWN AND N.W.S. QUINN. 1992. Body size, age distribution, and reproduction in a northern population of wood turtles (*Clemmys insculpta*). Can J. Zool. 70: 462-469.

CAMPBELL, C.A. AND G.R. DONALDSON. 1980. A status report for the eastern spiny softshell turtle, *Trionyx spiniferus spiniferus*, in Canada. M.E. Obbard [ed.]. Unpubl. Rep. Ont. Min. Nat. Resour., Wildlife Branch, Toronto. 50 p.

CEBEK, J.E. 1986. Thermal ecology of the bullfrog, *Rana catesbeiana*, in southern Ontario. M. Sc. Thesis, Trent Univ., Peterborough, Ontario. 72 p.

CHIPPINDALE, P. 1984. A study of the spotted turtle (*Clemmys gutatta*) in the Mer Bleue Bog. Conservation Studies Publ. No. 25, National Capital Commission, Ottawa. 84 p.

CHIPPINDALE, P. 1985. The Mer Bleue spotted turtles: results of 1984 study. Unpubl. Rep. National Capital Commission, Ottawa.

COLEMAN, K. 1995. Bullfrog Management in Ontario. Transfer Line, a newsletter of the Southern Region Science and Technology Transfer Unit, Volume 2(3): 1-3. Ont. Min. Nat. Resour., Kemptville.

COOK, F.R. 1984. Introduction to Canadian amphibians and reptiles. Natl. Mus. Nat. Sci., Ottawa. 200 p.

COOK, F.R., J.D. LAFONTAINE, S. BLACK, L. LUCIUK AND R.V. LINDSAY. 1980. Spotted turtles (*Clemmys guttata*) in eastern Ontario and adjacent Quebec. Can. Field-Nat. 94(4): 411-415.

DAIGLE, C., A. DESROSIERS and J. BONIN. 1994. Distribution and abundance of common map turtles, *Graptemys geographica*, in the Ottawa River, Québec. Can. Field Nat. 108:84-86.

ERNST, C.H. 1967. A mating aggregation of the turtle, *Clemmys guttata.* Copeia 1967: 473-474.

ERNST, C.H. 1976. Ecology of the spotted turtle, *Clemmys guttata* (Reptilia, Testudines, Testudinidae) in southeastern Pennsylvania. J. Herptol. 10: 25-33.

FITCH, H.S. 1963. Natural history of the black rat snake (*Elaphe obsoleta obsoleta*) in Kansas. Copeia 4: 649-658.

FITCH, H.S. AND H.W. SHIRER. 1971. A radiotelemetric study of spatial relationships in some common snakes. Copeia 1: 118-128.

FOSCARINI, D.A. 1994. Demography of the wood turtle (*Clemmys insculpta*) and habitat selection in the Maitland River valley. M.Sc. Thesis. University of Guelph, Guelph, Ontario. 108 p.

GRAHAM, T.E. AND A.A. GRAHAM. 1992. Metabolism and behavior of wintering common map turtles, *Graptemys geographica*, in Vermont. Can. Field - Natur. 106 (4):517-519

HAXTON, T. 1997. Home range and habitat selectivity of spotted turtles (*Clemmys guttata*) in central Ontario: implications for a management strategy. M.Sc. Thesis. Trent University, Peterborough, Ontario.

HAXTON, T. and M. BERRILL. 1999. Habitat selectivity of spotted turtles (*Clemmys guttata*) in central Ontario. Can. J. Zool. 77:593-599.

KING, R.B. 1987. Reptile distributions on islands in Lake Erie. J. Herptol. 21(1): 65-67.

LITZGUS, J. 1996. Life history and demography of a northern population of spotted turtles, *Clemmys guttata*. M.Sc. Thesis. University of Guelph, Guelph, Ontario. 145 p.

LOVICH, J.E. 1988. Geographic variation in the seasonal cycle of spotted turtles, *Clemmys guttata*. J. Herptol. 22: 482-485.

OBBARD, M.E. 1985. A status report for the wood turtle (*Clemmys insculpta*) in Ontario with an overview of its status in Canada. Unpubl. Rep. Ont. Min. Nat. Resour., Wildlife Branch, Toronto. 43 p.

OLDHAM, M.J. 1984. A preliminary list of the reptiles of Essex County. Can. Amphibian and Reptile Conserv. Soc. Bull. 22(1): 1-8.

ONTARIO MINISTRY OF NATURAL RESOURCES 1994. Bullfrog Management in Ontario. K. Coleman and R. Cholmondeley [eds.] Southern Region Science and Technology Transfer Unit Workshop Proceedings WP-005. 38 p.

PARSONS, H.J. 1977. The black rat snake in Ontario - Rideau Lakes population. BUFO Inc. for Ont. Min. Nat. Resour., Toronto. 49 p.

PLATT, D.R. 1969. Natural history of the hognose snakes, *Heterodon platyrhinos* and *Heterodon masicus*. University of Kansas Publications. Museum of Natural History, V.18, No.4. Lawrence, Univ. Kansas.

QUINN, N.W.S. and D.P. TATE. 199. Seasonal movements and habitat of wood turtles (*Clemmys insculpta*) in Algonquin Park, Canada. J. of Herp. 25:217-220.

SMITH, H.M. 1978. A guide to field identification - amphibians of North America. Golden Press, New York, and Western Publishing Co. Inc., Racine, Wisconsin. 160 p.

SMITH, H.M. 1978. A guide to field identification - reptiles of North America. Golden Press, New York, and Western Publishing Co. Inc., Racine, Wisconsin. 240 p.

STICKEL, W.H. AND J.H. COPE. 1947. The home ranges and wanderings of snakes. Copeia 7: 127-136.

MAMMALS

BERGERUD, A.T. 1974. The role of the environment in the aggregation, movement and disturbance behaviour of caribou. Volume 2, pages 552-584 *in* V. Geist and F. Walther [eds.] The behaviour of ungulates and its relation to management. The Papers of an International Symposium held at the University of Calgary, Alberta, Canada, 2-5 November 1971. Morges, Switzerland: International Union for Conservation of Nature and Natural Resources, IUCN Publications New Series No. 24.

BUSKIRK, S.W. AND R.A. POWELL. 1994. Habitat ecology of fishers and American martens. Pages 283-396 *in* S.W. Buskirk, A.S. Harestad and M.G. Raphael [comps, eds.] Martens, sables and fishers: biology and conservation. Ithica, N.Y. Cornell University Press.

CALEF, G. 1981. Caribou and the barren-lands. Firefly Books, Ltd. Scarborough, Ontario. 176 p.

COWAN, I.M. 1936. Nesting habits of the flying squirrel, *Glaucomys sabrinus*. J. Mammal. 12(3): 233-238.

CRINGAN, A.T. 1957. History, food habits and range requirements of the woodland caribou of continental North America. Pages 485-501 *in* Reprint from Trans. of the 22nd North Am. Wildl. Conf., Washington, D.C.

DE VOS, A. 1952. Ecology and management of fisher and marten in Ontario. Ont. Dep. Lands, Toronto, On. 90 p.

FRANCIS, G.R. AND A.B. STEPHENSON. 1972. Marten ranges and food habits in Algonquin Park, Ontario. Ont. Min. Nat. Resour. Rep. No. 91.

GARENT, Y. and M. CRETE. 1997. Fisher, *Martes pennanti*, home range characteristics in a high density untrapped population in southern Québec. Can. Field Nat. 111: 359-365.

KILPATRICK, H. AND P. REGO. 1994. Influence of season, sex, and site availability on fisher (*Martes pennanti*) rest-site selection in the central hardwood forest. Can. J. Zool. 72: 1416 – 1420.

KOHLER, G.M., W.R. MOORE AND A.R. TAYLOR. 1975. Preserving the pine marten: management guidelines for western forests. Western Wildlands 2: 31-36.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1984. Guidelines for moose habitat management in Ontario. Wildlife Branch, Toronto. 154 p.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1990. The moose in Ontario. Book 1- Moose biology, ecology and management. M. Buss and R. Truman [eds.] Ont. Min. Nat. Resour. and Ont. Fed. Anglers and Hunters. 33 p.

QUINN, N. 1984. The lynx. Ont. Min. Nat. Resour., Toronto. 24 p.

SKOOG, R.O. 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Ph.D. Thesis. Berkeley: Univ. California 699 p.

SOLLBERGER, D.E. 1940. Notes on the life history of the small eastern flying squirrel. J. Mammal. 21(3): 282-293.

SOLLBERGER, D.E. 1943. Notes on the breeding habits of the eastern flying squirrel (*Glaucomys volans volans*). J. Mammal. 24(2): 163-173.

THOMPSON, I.D. 1991. Could marten become the spotted owl of eastern Canada? For. Chron. 67: 136-140.

WATT, W.R., J. A. BAKER, A. BARAUSKAS, D.M. HOGG, J.G. MCNICOL AND B. NAYLOR. 1996. Forest Management Guidelines for the Provision of Marten Habitat. Ont. Min. Nat. Resour. 27 p.

WYNNE, K.M. AND J.A. SHERBURNE. 1984. Summer home range use by adult marten in northwestern Maine. Can. J. Zool. 62: 941-943.

BIRDS - GENERAL

BEST, L.B. 1983. Bird use of fencerows: implications of contemporary fencerow management practices. Wildl. Soc. Bull. 11: 343-347.

CADMAN, M.D., P.F.J. EAGLES, F.M. HELLEINER. 1988. Atlas of the breeding birds of Ontario. University of Waterloo Press, Waterloo, Ontario. 617 p.

DANCE, K.W., AND D.M. FRASER. 1985. Use of the breeding bird atlas data in environmental planning. Ont. Breed. Bird Atlas Newsletter 14: 1-2.

GODFREY, W.E. 1966. The birds of Canada. Natl. Mus. Can. Bull. 203. 423 p.

EFFECTS OF HABITAT FRAGMENTATION

ANDRÉN, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71: 355-366.

AUSTEN, M.J., C.M. FRANCIS, D.B. BURKE AND M.S.W. BRADSTREET. in prep. Effects of forest fragmentation on woodland birds in southern Ontario.

BURKE, D.M. AND E. NOL. 1998. Influence of food abundance, nest site habitat, and forest fragmentation on breeding ovenbirds. Auk 115: 96-104.

BURKEY, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. Oikos 55: 75-81.

FAABORG, J., M. BRITTINGHAM, T. DONOVAN AND J. BLAKE. 1993. Habitat fragmentation in the temperate zone: a perspective for managers. Pages 331-338 *in* Status and management of neotropical migratory birds. D.M. Finch and P.W. Stangel [eds.] USDA Forest Serv. Gen. Tech. Rep. RM-229, Rocky Mt. Forest Range Exp. Sta., Fort Collins, CO.

FAHRIG, L. 1997. Relative effects of habitat loss and fragmentation on population extinction. J. Wildl. Manage. 61(3): 603-610.

FREEMARK, K.E. 1989. Landscape ecology of forest birds in the northeast. Pages 7-12 *in* Is forest fragmentation a management issue in the northeast? R.M. DeGraaf and W.M. Healy [comps.] USDA Forest Serv. Gen Tech. Rep. NE-140, Northeasterm Froest Exp. Sta., Radnor, PA.

FREEMARK, K. AND B. COLLINS. 1992. Landscape ecology of birds breeding in temperate forest fragments. Pages 443-454 *in* J.M. Hagan and D.W. Johnson, [eds.] Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington D.C. 609 p.

FREEMARK, K.E., J.B. DUNNING, S.J. HEJL AND J.R. PROBST. 1995. A landscape ecology perspective for research, conservation and management. Pages 381-427 *in* T. Martin and D. Finch [eds.] Ecology and Management of Neotropical Migratory Birds: A synthesis and Review of the Critical Issues. Oxford University Press, Cambridge, UK.

FRIESEN, L.E., P.F.J. EAGLES AND J.R. MACKAY. 1995. Effects of residential development on forest-dwelling neotropical migrant songbirds. Conserv. Biol. 9: 1408-1414.

HAYDEN, T.J. 1985. Minimum area requirements of some breeding bird species in fragmented habitats in Missouri. M.S Thesis, Univ. Missouri-Columbia.

HERKERT, J.R. 1994. The effects of habitat fragmentation on Midwestern grassland communities. Ecol. Appl. 4: 461-471.

JOHNSON, R.G. AND S.A. TEMPLE. 1986. Assessing habitat quality for birds nesting in fragmented tallgrass prairies. Pages 245-249 *in* J. Verner, M.L. Morrison and C.J. Ralph, [eds.] Wildlife 2000: modeling habitat relationships of terrestrial vertebrates. Univ. Wisconsin Press, Madison.

REESE, K.P. AND J.T. RATTI. 1988. Edge effect: a concept under scrutiny. Trans. North Am. Wildl. Nat. Resourc. Conf 53:127-136.

ROBBINS, C.S. 1979. Effects of forest fragmentation on bird populations. Pages 198-212 *in* R.M. Degraaf and N. Tilghman [eds.] Proceedings of the Workshop on Management of North-Central and Northeastern Forests for Nongame Birds. U.S. Forest Serv. Gen. Tech. Rep. NC-51.

ROBBINS, C.S. 1988. Forest fragmentation and its effects on birds. Pages 61-65 *in* Managing North Central forests for non-timber values. J.E. Johnson [ed]. SAF publication 88-04. Soc. Am. Foresters.

ROBINSON, S.K., F.R. THOMPSON, III, T.M. DONOVAN, D.R. WHITEHEAD AND J. FAABORG. 1987. Regional forest fragmentation and the nesting success of migratory birds. Science 267: 1987-1990.

SZAFONI, R.E. 1992. Forest fragmentation - the breaking up of wildlife's home. Ill. Steward 1:6-8.

TEMPLE, S.A. 1986. Predicting impacts of habitat fragmentation on forest birds: A comparison of two models. Pages 301-304 *in* Wildlife 2000; Modeling habitat relationships of terrestrial vertebrates. J. Verner, M.L. Morrison and C.J. Ralph [eds.] University of Wisconsin Press, Madison

VENIER, L.A. AND L. FAHRIG. 1996. Habitat availability causes the species abundance-distribution relationship. Oikos 76: 564-570.

VILLARD, M.-A., P.R. MARTIN AND C.G. DRUMMOND. 1993. Habitat fragmentation and pairing success in the Ovenbird (*Seiurus aurocapillus*). Auk 110: 759-768.

VILLARD, M.-A., G. MERRIAM AND B.A. MAURER. 1995. Dynamics in subdivided populations of neotropical migratory birds in a fragmented temperate forest. Ecology 76: 27-40.

WHITCOMB, B.L., R.F. WHITCOMB AND D. BYSTRAK. 1977. Island biogeography and "habitat islands" of eastern forest. III. Long-term turnover and effects of selective logging on the avifauna for forest fragments. Amer. Birds 31: 17-23.

WHITCOMB, R.F., C.S. ROBBINS, J.F. LYNCH, B.L. WHITCOMB, M.K. KLIEMKIEWICZ AND D. BYSTRAK. 1981. Effects of forest fragmentation on avifauna of the eastern deciduous forest. Pages 125-205 *in* Forest island dynamics in man-dominated landscapes. R.L. Burgess and D.M. Sharpe [eds.] Springer-Verlag, New York.

WATERFOWL AND OTHER MARSHLAND BIRDS

ANDERSON, J.M. 1977. Yellow Rail. Pages 66-70 *in* G.C. Sanderson [eds.] Management of migratory shore and upland game birds in North America. Int. Assoc. Fish Wildl. Agencies, Washington.

AUSTIN, J.E., AND M.R. MILLER. 1995. Northern Pintail (*Anas acuta*). *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 163. The Acadamy of Natural Sciences, Philadephia, and The American Ornithologists' Union, Washington, DC. 32pp.

BART, J., A. STEHN, J.A. HERRICK, N.A. HEASLIP, T.A. BOOKHOUT AND J.R. STENZEL. 1984. Survey methods for breeding Yellow Rails. J. Wildl. Manage. 48: 1382-1386.

BERGMAN, R. D. 1973. Use of southern boreal lakes by postbreeding Canvasbacks and Redheads. J. Wildl. Manage. 37:160-170.

BERGMAN, R.D., P. SWAIN AND M.W.WELLER. 1970. A comparative study of nesting Forster's and Black Terns. Wilson Bull. 82: 435-444.

BOOKHOUT, T.A. 1995. Yellow Rail (*Coturnicops noveboracensis*). *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 139. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C. 16 p.

CAMPBELL, L. H. AND H. MILNE. 1977. Goldeneye feeding close to sewer outfalls in winter. Wildfowl 28:81-85.

CRINGAN, A.T. 1957. Notes on the biology of the Red-necked Grebe in western Ontario. Can. Field-Natur. 71: 72-73.

DENNIS, D. G., G. B. MCCULLOUGH, N. R. NORTH AND R. K. ROSS. 1984. An updated assessment of migrant waterfowl use of the Ontario shorelines of the southern Great Lakes. Pages 37-42 in S. G. Curtis, D. G. Dennis, and H. Boyd, eds. Waterfowl studies in Ontario, 1973-81. Occasional Paper No. 54, Can. Wildl. Serv.

DENNIS, D. G. AND R. E. CHANDLER. 1974. Waterfowl use of the Ontario shorelines of the southern Great Lakes during migration. Pages 58-65 in H. Boyd, ed. Canadian Wildlife Service studies in eastern Canada, 1969-73. Can. Wildl. Serv. Rep. Ser. No. 29.

DE SMET, K.D. 1982. Status report on the Red-necked Grebe (*Podiceps grisegena*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

DUNN, E.H. 1979. Nesting biology and development of young in Ontario Black Terns. Can. Field-Natur. 93: 276-281.

EADIE, J.M., M.L. MALLORY AND H.G. LUMSDEN. 1995. Common Goldeneye : *Bucephala clangula*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No.170. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C.
32 p.

FRILEY, C.E., JR., L.H. BENNETT AND G.O. HENDRICKSON. 1938. The American Coot in Iowa. Wilson Bull. 50: 81-86.

GIBBS, J.P., S. MELVIN AND F.A. REID. 1992. American Bittern : *Botaurus lentiginosus*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 18. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C.

GIBBS, J.P., F.A. REID, AND S.M. MELVIN. 1992b. Least Bittern : *Ixobrychus exilis*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 17. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 12 p.

HALL-ARMSTRONG, J. AND E.R. ARMSTRONG. 1982. The status of Sandhill Cranes in Cochrane Dsitrict of northeastern Ontario. Unpubl. Rep., Ont. Min. Nat. Resour.

HUME, R. A. 1976. Reactions of Goldeneyes to boating. British Birds 69:178-179.

KORSCHGEN, C. E., L. S. GEORGE AND W. L. GREEN. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildl. Soc. Bull. 13:290-296.

LUMSDEN, H.G. 1971. The status of the Sandhill Crane in northern Ontario. Can. Field-Natur. 85: 285-293.

MATHEWS, G. V. T. 1982. The control of recreational disturbance. Chap. 42, pages 325-330 in D. A. Scott, ed. Managing wetlands and their birds, a manual of wetland and waterfowl management. Proceedings 3rd Technical Meeting on Western Palearctic Migratory Bird Management, Biologische Station Rieselfelder Münster, Federal Republic of Germany, 12-15 October 1982.

MEANLEY, B. 1969. Natural history of the King Rail. U.S. Dep. Inter., Fish Wildl. Serv., N. Amer. Fauna No. 67.

MEANLEY, B. 1992. King Rail: *Rallus elegans*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 3. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 12 p.

RILEY, J.L. 1982. Habitats of Sandhill Cranes in southern Hudson Bay Lowland, Ontario. Can Field-Natur. 96: 51-55.

ROSS, R. K. 1984. Migrant waterfowl use of the major shorelines of eastern Ontario. Pages 53-62 in S. G. Curtis, D. G. Dennis, and H. Boyd, eds. Waterfowl studies in Ontario, 1973-81. Occasional Paper No. 54, Can. Wildl. Serv.

SMITH, A. G. 1971. Ecological factors affecting waterfowl production in the Alberta parklands. U.S. Dep. Interior, Fish Wildl. Serv. Resour. Publ. 98. 49 pp.

TACHA, T.C., S.A. NESBITT AND P.A. VOHS. 1992. Sandhill Crane: *Grus canadensis*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 31. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 24 p.

TEBBEL, P.D. AND C.D. ANKNEY. 1982. Status of Sandhill Cranes (*Grus canadensis*) in central Ontario. Can. Field-Natur. 96: 136-166.

BIRDS ASSOCIATED WITH GRASSLAND AND OLD FIELD HABITATS

AILES, I.W. 1980. Breeding bird biology and habitat use of the Upland Sandpiper in central Wisconsin. Passenger Pigeon 42: 53-63.

AILES, I.W. AND J.E. TOEPFER. 1977. Home range and daily movement of radio-tagged Upland Sandpipers in central Wisconsin. Inland Bird Band. News 49: 203-212.

ASKINS, R.A. 1993. Population trends in grassland, shrubland, and forest birds in eastern North America. Pages 1-34 *in* D.M. Power, [ed.] Current Ornithology, Vol. 11. Plenum Press, New York.

BASKETT, T.S., D.A. DARROW, D.L. HALLETT, M.J. ARMBUSTER, J.A. ELLIS, B.F.SPARROWE, AND P.A. KORTE. 1980. A handbook for terrestrial habitat evaluation in central Missouri. U.S. Fish and Wild. Serv. Resour. Publ. 133. 155 p.

BEDARD, J. AND G. LAPOINTE. 1984. The Savannah Sparrow territorial system: can habitat features be related to breeding success? Can. J. Zool. 62: 1819-1828.

BENT, A.C. 1929. Life histories of North American shorebirds. U.S. Natl. Mus. Bull. 146. 420 p.

BENT, A.C. 1968. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies. U.S. Natl. Mus. Bull. 237. 1020 p.

BERGER, A.J, 1968. *Pooecetes gramineus gramineus* (Gmelin): Eastern Vesper Sparrow. Pages 863-882 *in* O.L. Austin [ed.] Life Histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows and allies. U.S. Natl. Mus. Bull. 237. 1020 p.

BEST, L.B. AND N.L. RODENHOUSE. 1984. Territory preference of Vesper Sparrows in cropland. Wilson Bull. 96: 72-82.

BLANKESPOOR, G.W. 1980. Prairie restoration: effects on nongame birds. J. Wildl. Manage. 44: 667-672.

BOLLINGER, E.K. AND T.A. GAVIN. 1989. The effects of site quality on breeding site fidelity in bobolinks. Auk 106: 584-594.

BOLLINGER, E.K AND T.A. GAVIN. 1992. Eastern Bobolink populations: ecology and conservation in an agricultural landscape. Pages 497-506 *in* J.M. Hagan, III and D.W. Johnston [eds.] Ecology and conservation of neotropical migrant landbirds. Smith Inst. Press, Washington D.C.

BOWEN, B.S. AND A.D. KRUSE. 1993. Effects of grazing on nesting Upland Sandpipers in southcentral North Dakota. J. Wildl. Manage. 57: 291-301.

BOWEN, D.E., JR. 1976. Coloniality, reproductive success, and habitat interactions of the Upland Sandpiper (*Bartramia longicauda*). Ph.D. Thesis, Kansas Univ., Manhattan. 127 p.

BURGER, L.D., L.W. BURGER AND J. FAABORG. 1994. Effects of prairie fragmentation and predation on artificial nests. J. Wildl. Manage. 58: 249-254.

CADMAN, M.D. 1986. Status report on the Loggerhead Shrike (*Lanius ludovicianus*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

CAMP, M. AND L.B. BEST. 1994. Nest density and nesting success of birds in roadsides adjacent to rowcrop fields. Am. Midl. Nat. 131: 347-358.

CAMPBELL, C.A. 1975. Distribution and breeding success of the Loggerhead Shrike in southern Ontario. Can. Wildl. Serv. Rep. No. 6065.

CASTRALE, J.S. 1983. Selection of song perches by sagebrush-grassland birds. Wilson Bull. 95: 647-655.

CLAWSON, R.L. 1991. Henslow's Sparrow habitat, site fidelity, and reproduction in Missouri. Fed. Aid. Perf.. Rep., Mo. Dep. Conserv., Proj. W-14-R-45. 18p.

CONNELLY, J.W., M.W. GRATSON, AND K.P. REESE. 1998. Sharp-tailed Grouse: *Tympanuchus phasianellus*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 354. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p

DALE, B.C. 1984. Birds of grazed and ungrazed grasslands in Saskachewan. Blue Jay 42: 102-105.

DAMACH, C.A. AND E.E. GOOD. 1940. The effect of certain land use practices on populations of breeding birds in southwestern Ohio. J. Wildl. Manage. 4: 63-76.

DIXON, C.L. 1972. A population study of Savannah Sparrows on Kent Island in the Bay of Fundy. Ph.D. Thesis, Univ. Michigan, Ann Arbor. 143 p.

DIXON, C.L. 1978. Breeding biology of the Savannah Sparrow on Kent Island. Auk 95: 235-246.

FARRIS, A.L. AND J.H. COLE. 1981. Strategies and goals for wildlife habitat restoration on agricultural lands. Trans. Am. Wildl. Nat. Resour. Conf. 46: 130-136.

GAVIN, T.A. AND E.K. BOLLINGER. 1988. Reproductive correlates of breeding site fidelity in Bobolinks, *Dolichonyx oryzivorus*. Ecology 69: 96-103.

GOOD, E.E. AND C.A. DAMBACH. 1943. Effect of land use practices on breeding bird populations in Ohio. J. Wildl. Manage. 7: 291-297.

HARRISON, K.G. 1977. Perch height selection of grassland birds. Wilson Bull. 89: 486-487.

HERKERT, J.R. 1991. An ecological study of the breeding birds of grassland habitat within Illinois. Ph.D. Thesis, Univ. Illinois, Urbana. 115 p.

HERKERT, J.R. 1994. Breeding bird communities of midwestern prairie fragments: the effects of prescribed burning and habitat-area. Nat. Areas J. 14: 128-135.

HERKERT, JR. 1994. Status and habitat selection of the Henslow's Sparrow in Illinois. Wilson Bull. 106: 35-45.

HERKERT, J.R., R.E. SZAFONI, V.M. KLEEN AND J.E. SCHWEGMAN. 1993. Habitat establishment, enhancement and management for forest and grassland birds in Illinois. Ill. Dep. Conserv., Nat. Heritage Tech. Publ. No. 1. 20 p.

HOLT, D. W. AND S. M. LEASURE. 1996. Short-eared Owl (*Asio flammeus*). *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 62. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C.

HULBERT, L.C. 1986. Fire effects on tallgrass prairie. Proc. North Am. Prairie Conserv. 9: 138-142.

HURLEY, R.L. AND E.W. FRANKS. 1976. Changes in the breeding ranges of two grassland birds. Auk 93: 108-115.

HYDE, A.S. 1939. The life history of Henslow's Sparrow, *Passerherbulus henslowi* (Audubon). Univ. Mich. Misc. Publ. No. 41. 72 p.

JOBANEK,G.A. 1994. History of the Bobolink in Oregon. Oreg. Birds 20: 50-54.

JOHNSON, R.G. AND S.A. TEMPLE. 1990. Nest predation and brood parasitism of tallgrass prairie birds. J. Wildl. Manage. 54: 106-111.

JOYNER, D.E. 1978. Use of an old field habitat by Bobolinks and Red-winged Blackbirds. Can. Field-Nat. 92: 383-386.

MCNICHOLL, M.K. 1988. Ecological and human influences on Canadian populations of grassland birds. Int. Counc. Bird Preservation Tech. Publ. 7: 1-25.

OLSEN, A.R. 1959. Report on the status of Sharp-tailed Grouse, Kenora District. Unpubl. Rep., Ont. Min. Nat. Resour.

POTTER, P.E. 1972. Territorial behavior in Savannah Sparrows in southeastern Michigan. Wilson Bull. 84: 48-59.

RENKEN, R.B. AND J.J. DINSMORE. 1987. Nongame bird communities in managed grasslands in North Dakota. Can. Field-Nat. 101: 551-557.

REYNOLDS, R.E., T.L. SHAFFER, J.R. SAUER AND B.G. PETERJOHN. 1994. Conservation reserve program: benefit for grassland birds in the northern plains. Trans. North Am. Wildl. Nat. Resour. Conf. 59: 328-336.

SAMSON, F.B. 1980. Island biogeography and the conservation of nongame birds. Trans. Am. Wildl. Nat. Resour. Conf. 45: 245-251.

SNYDER, L.L. 1935. A study of the Sharp-tailed Grouse. Univ. Toronto Biol. Ser. No. 40.

SWANSON, D.A. 1996. Nesting ecology and nesting habitat requirements of Ohio's grassland-nesting birds: A literature review. Ohio Department of Natural Resources, Division of Wildlife, Ohio Fish and Wildlife Report 13. 60pp.

VAN HORNE, B. 1983. Density as a misleading indicator of habitat quality. J. Wildl. Manage. 47: 893-901.

VICKERY, P.D., M.L. HUNTER, JR., AND S.M. MELVIN. 1994. Effects of habitat area distribution of grassland birds in Maine. Conserv. Biol. 8: 1087-1097.

VOLKERT, W.K. 1992. Response of grassland birds to a large-scale prairie planting. Passenger Pigeon 54: 191-196.

WHITMORE, R.C. 1979. Temporal variation in the selected habitats of a guild of grassland sparrows. Wilson Bull. 91: 5929-598.

WHITMORE, R.C. 1981. Structural characteristics of Grasshopper Sparrow habitat. J. Wildl. Manage. 45: 811-814.

WIENS, J.A. 1963. Aspects of Cowbird parasitism in southern Oklahoma. Wilson Bull. 75: 130-134.

WIENS, J.A. 1969. An approach to the study of ecological relationships among grassland birds. Ornithol. Monogr. 8: 1-93.

WIENS, J.A. 1973. Interterritorial habitat variation in Grasshopper and Savannah Sparrows. Ecology 54: 877-884.

WIENS, J.A. 1973. Pattern and process in grassland bird communities. Ecol. Monogr. 43: 237-270.

WRAY, T., K.A. STRAIT AND R.C. WHITMORE. 1982. Reproductive success of grassland birds on a reclaimed surface mine in West Virginia. Auk 99: 157-164.

YOSEF, R. 1996. Logg[illegible]ead Shrike: *Lanius ludovicianus. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 231. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 28 p.

BIRDS ASSOCIATED WITH FORESTS

ASKINS, R.A., M.J. PHILBRICK, AND D.S. SUGENO. 1987. Relationship between the regional abundance of forest and the composition of forest bird communities. Biol. Conserv. 39:129-52.

BENT, A.C. 1953. Life histories of North American warblers. U.S. Natl. Mus. Bull. 203. 733 p.

BENT, A.C. 1958. Life histories of North American blackbirds, orioles, tanagers, and allies. U.S. Natl. Mus. Bull. 211. 490 p.

BENT, A.C. 1964. Life histories of North American nuthatches, wrens, thrashers, and their allies. New York : Dover Publications. 90 p.

BERTIN, R.I. 1977. Breeding habits of the Wood Thrush and Veery. Condor 79: 303-311.

BLAKE, J.G. 1986. Species-area relationship of migrants in isolated woodlots in east-central Illinois. Wilson Bull. 98:291-296.

BLAKE, J.G. AND J.R. KARR. 1984. Species compositions of bird communities and the conservation benefit of large versus small forests. Biol. Conserv. 30:173-187.

BLAKE, J.G. AND J.R. KARR. 1987. Breeding birds of isolated woodlots: area and habitat relationships. Ecology 68: 1724-1734.

BRECKENRIDGE, W.J. 1956. Measurements of the habitat niche of the Least Flycatcher. Wilson Bull. 68: 47-51.

BUSHMAN, E.S. AND G.D. THERRES. 1988. Habitat management guidelines for forest interior breeding birds of coastal Maryland. Maryland Department of Natural Resources; Forest, Park, and Wildlife Service, Wildl. Tech. Publ. 88-100. Annapolis.

CHRISTY, B.H. 1942. *Empidonax virescens* (Villeot). Acadian Flycatcher. Pages 183-197 *in* A.C. Bent [ed.] Life histories of North American flycatchers, larks, swallows and allies. Bull. U.S. Natl. Mus. No. 179.

COLLINS, S.L. 1983. Geographic variation in habitat structure of the Black-throated Green Warbler (*Dendroica virens*). Auk 100: 382-389.

DAVIS, D.E. 1959. Observations on territorial behavior of Least Flycatchers. wilson bull. 71: 73-85.

DUNN, J.L. AND K.L. GARRETT. 1997. Cerulean Warbler (*Dendroica cerulea*). *in* A Field Guide to Warblers of North America. Houghton Mifflin, New York, NY. p.560-568.

ELLISON, W.G. 1992. Blue-gray Gnatcatcher: *Polioptila caerulea. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 23. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

FLASPOHLER, D. J. 1996. Nesting success of the Prothonotary Warbler (*Protonotaria citrea*) in the upper Mississippi River bottomlands. Wilson Bull. 108:457-466.

GRUBB, T.C. JR. AND V.V. PRAVOSUDOV. 1994. Tufted Titmouse: *Parus bicolor. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 86. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 16 p.

HALL, G.A. 1994. Magnolia Warbler: *Dendroica magnolia. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 136. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 16 p.

HAMES, S. 1998. Birds in Forested Landscapes analyzes early results. Birdscope 12(2): ?-?. (also see *http://www.birds.cornell.edu/bfl/BFLBSc.htm*)

HAGEN, J.M. III AND D.W. JOHNSON [eds.] Ecology and conservation of neotropical landbirds. Smithsonian Institute Press. 609 p.

HAYDEN, T.J., J. FAABORG, AND R.L. CLAWSON. 1985. Estimates of minimum area requirements for Missouri forest birds. Trans. Missouri Acad. Sci. 19:11-22.

HOLMES, R.T. 1994. Black-throated Blue Warbler (*Dendroica caerulescens*). *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 87. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

HOOVER, J.P., M.C. BRITTINGHAM AND L.J. GOODRICH. 1995. Effects of forest patch size on nesting success of wood thrushes. Auk 112: 146-155.

IVERSON, L.R., R.L. OLIVER, D.P. TUCKER, P.G. RISSER, C.D. BURNETT, AND R.G. RAYBURN. 1989. The forest resources of Illinois: an analysis of spatial and temporal trends. Illinois Nat. Hist. Surv. Spec. Publ. No. 11. 181pp.

JACKMAN, S.M., AND J.M. SCOTT. 1975. Literature review of twenty-three selected forest birds of the Pacific Northwest Region 6. U.S. Forest Serv. 382 p.

JAMES, R.D. 1998. Blue-headed Vireo: *Vireo solitarius. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 379. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 24 p.

JOHNSON, D.W. AND J.M. HAGAN III. 1992. An analysis of long-term breeding bird censuses from eastern deciduous forests. Pages 75-84 *in* J.M. Hagen III and D.W. Johnson [eds.] Ecology and Conservation of Neotropical Landbirds. Smithsonian Institute Press. 609 p.

JONES, P.W. AND T.M. DONOVAN. 1996. Hermit Thrush: *Catharus guttatus. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 261. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 28 p.

KRICHER, J.C. 1995. Black and White Warbler, *Mniotilta varia. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 158. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

LAWRENCE, L. DE K. 1953. Notes on the nesting behavior of the Blackburnian Warbler. Wilson Bull. 65: 135-144.

MARTIN, T.E. 1992. Breeding productivity considerations: what are the appropriate habitat features for management? Pages 455-473 *in* J.M. Hagan and D.W. Johnson, [eds.] Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington D.C. 609 p.

MCCRACKEN, J.D. 1981. Status report on the Prothonotary Warbler (*Protonotaria citrea*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

MCINTYRE, N. 1995. Effects of forest patch size on avian diversity. Landscape Ecol. 10: 85-99.

MEDIN, D.E. AND G.D. BOOTH. 1989. Responses of birds and small mammals to single-tree selection logging in Idaho. U.S. Forest Serv. Resourc. Paper INT-408. 11p.

MOLDENHAUER, R.R. AND D.J. REGELSKI. 1996. Northern Parula: *Parula americana. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 215. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 24 p.

MOORE, F.R. AND T.R. SIMONS. 1992. Habitat suitability and stopover ecology of neotropical landbird migrants. Pages 345-355 *in* J.M. Hagan and D.W. Johnson, [eds.] Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington D.C. 609 p.

MORSE, D.H. 1993. Black-throated Green Warbler: *Dendroica virens. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 55. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

MORSE, D.H. 1994. Blackburnian Warbler: *Dendroica fusca. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 102. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

MOSKOFF, W. 1995. Veery : *Catharus fuscescens. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 142. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 16 p.

OLIARNYK, C.J. AND R.J. ROBERTSON 1996. Breeding behavior and reproductive success of Cerulean Warblers in southeastern Ontario. Wilson Bull. 108:673-684.

PORNELUZI, P., J. BEDNARZ, L.J. GOODRICH, N. ZAWANDA AND J. HOOVER. 1993. Reproductive performance of territorial Ovenbirds occupying forest fragments and a contiguous forest in Pennsylvania. Conserv. Biol. 7: 618-622.

PRAVOSUDOV, V.V. AND T.C. GRUBB. 1993. White-breasted Nuthatch*: Sitta carolinensis. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 54. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 16 p.

PROBST, J.R. AND J. WEINRICH. 1993. Relating Kirtland's Warbler population to changing landscape composition and structure. Landscape Ecol. 8: 257-271.

ROBBINS, C.S., D.K. DAWSON AND B.A. DOWELL. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic states. Wildl. Monogr. No. 103. 34 p.

RODEWALD, P.G. AND R.D. JAMES. 1996. Yellow-throated Vireo : *Vireo flavifrons. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 247. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

ROHRBRAUGH, R. 1997. Birds in forested landscapes. Birdscope. 11(2): 4-5.

SIDEL, G.E. AND R.C. WHITMORE. 1982. Effect of forest structure on American Redstart foraging behavior. Wilson Bull. 94: 289-296.

SUTHERLAND, D. 1986. Magnolia Warbler breeding in the Regional Municipality of Halton, Ontario. Ont. Birds 4: 69-71.

TERBORGH, J. 1992. Why American songbirds are vanishing. Sci. Am. 266:98-104.

TILGHMAN, N.G. 1987. Characteristics of urban woodlands affecting breeding bird diversity and abundance. Landscape and Urban Planning 14:481-495.

WILCOVE, D.S. 1985. Nest predation in forest tracts and the decline of migratory songbirds. Ecology 66:1211-1214.

WOODFORD, J. 1962. The Tufted Titmouse "invades" Ontario. Fed. Ont. Natur. Bull. 95: 18-20.

YAHNER, R.H. 1988. Changes in wildlife communities near edges. Conserv. Biol. 2:333-339.

WOODPECKERS

BENT, A.C. 1939. Life histories of North American woodpeckers. U.S. Natl. Mus. Bull. No. 174. 334 p.

BULL, E.L. AND R.S. HOLTHAUSEN. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. J. Wildl. Manage. 57: 335-345.

BULL, E.L., R.S. HOLTHAUSEN AND M.G. HENJUM. 1992. Roost trees used by pileated woodpeckers in northeastern Oregon. J. Wildl. Manage. 56: 786-793.

FREEMARK, K. AND B. COLLINS. 1992. Landscape ecology of birds breeding in temperate forest fragments. Pages 443-454 *in* J.M. Hagan and D.W. Johnson, [eds.] Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington D.C. 609 p.

HOYT, S.F. 1957. The ecology of the Pileated Woodpecker. Ecology 38: 246-256.

KILHAM, K. 1971. Reproductive behavior of Yellow-bellied Sapsuckers. I. Preference for nesting in *fomes*-infected aspens, and nest hole interrelations with flying squirrels, raccoons, and other animals. Wilson Bull. 83: 158-171.

KIRK, D.A. AND B.J. NAYLOR. 1996. Habitat requirements of the Pileated Woodpecker (*Dryocopus pileatus*) with special reference to Ontario. Ont. Min. Nat. Res., CRST Tech. Rep. No. 46. 65p.

NAYLOR, B., J. BAKER, A. BARAUSKAS, D. HOGG, J. MCNICOL AND W.R. WATT. 1996. Forest Management guidelines for the provision of Pileated Woodpecker habitat. Ont. Min. Nat. Resour. 30 p.

RAPTORS

BENT, A.C. 1961. Life histories of North American birds of prey. Parts I and II. (Reprints) Dover Publications, Inc., New York.

BONDRUP-NIELSEN, S. 1978. Vocalizations, nesting and habitat preferences of the boreal owl (*Aegolius funereus*) in north america. Unplubl. M.Sc. Thesis, Univ. Toronto.

BROLEY, M.J. 1952. Eagle Man. Pellegrini and Cudahy, New York. 210 p.

BRYANT, A.A. 1986. Influence of selective logging on Red-shouldered Hawks , *Buteo lineatus*, in Waterloo Region, Ontario. Can. Field-Natur. 100: 520-525.

CROCOLL, S.T., 1994. Red-shouldered Hawk: *Buteo lineatus*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 107. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 20 p.

ECKERT, A.W. 1974. The owls of North America. Garden City, N.Y. Doubleday and Co. 278 p.

EVERETT, M. 1977. A natural history of owls. The Hamlyn Publishing Group Ltd., London, England. 156 p.

GOODRICH, L.J., S. C. CROCOLL, AND S. E. SENNER. 1996. Broad-winged Hawk: *Buteo platypterus*. *in* A. Poole and F. Gill [eds.] The Birds of North America, No. 218. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 28 p.

MCKEATING, G. 1985. Charles Broley: eagles then and now in southern Ontario. Pages 25-34 *in* J.M. Gerrard and T.M. Ingram [eds.] The Bald Eagle in Canada. White Horse Plains Publ., Headingley.

NERO, R.W. 1979. Status report on the Great Gray Owl (*Strix nebulosa*) in Canada, 1979. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

NERO, R.W. AND R.R. TAYLOR. 1980. The Great Gray Owl - phantom of the northern forest. Smithsonian Institute Press, Washington, D.C. 167 p.

PENAK, B.L. 1983. The status of the Cooper's Hawk (*Accipiter cooperii*) in Ontario, with an overview of the status in Canada. committee on the Status of Endangered Wildlife in Canada, Ottawa.

RISLEY, C.J. 1982. The status of the Red-shouldered Hawk (*Buteo lineatus*) in Ontario, with an overview of the status in Canada. Committee on the Status of Endangered Species in Canada, Ottawa.

HARP, M.J. AND C.A. CAMPBELL. 1982. Breeding ecology and status of Red-shouldered Hawks (*Buteo lineatus*) in Waterloo Region. Ont. Field biol. 36: 1-10.

ROSENFIELD, R.N. AND J. BIELEFELDT. 1993. Cooper's Hawk: *Accipiter cooperii. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 75. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 24 p.

SQUIRE, J.R. AND R.T. REYNOLDS. 1997. Northern Goshawk: *Accipiter gentilis. in* A. Poole and F. Gill [eds.] The Birds of North America, No. 298. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C. 32 p.

APPENDIX D

Guidelines for Conducting Field Investigations

Some seasonal concentration areas, and many rare and specialized habitats and habitats of species of conservation concern in the municipality probably have not been identified or evaluated. Also there may identified habitats currently considered to be "potentially significant wildlife habitat" because the information about them is either insufficient, vague, or outdated. Well-planned field investigations should enable the planning authority to collect sufficient information for the identification, evaluation, and ranking of specific wildlife habitats according to their relative importance.

The following guidelines will help the planning authority to:

- provide comprehensive terms of reference for any field work
- obtain the required information, in a form that is useful to the planning authority
- minimize the cost and time required to conduct field investigations by obtaining sufficient information from a minimum number of site visits
- ensure that proper documentation of important information (e.g., location of rare species and habitats) is obtained by the planning authority
- ensure that field investigations are scheduled to be done at the proper time of year
- ensure that private property rights are respected

Pre-field investigation

- Have clear objectives for any field investigations, preferably in written form (e.g., to determine the significance of a site based on the evaluation criteria provided; to record as thoroughly as possible, all the different habitats on the site; to accurately record observations; to accurately map vegetation communities on the site)
- Determine the detail and intensity of the field investigation. For example, it may only involve a quick reconnaissance to determine whether the site has changed considerably from some earlier description of it, or it may be very detailed (e.g., collecting species information about a rare habitat).
- Collect and review all information pertaining to the identification and evaluation of the site. Such information usually includes OMNR Site District Reports and relevant literature, aerial photographs of the area, topographical maps, Ontario Base Maps, Ontario soils maps, the various atlases, and information from the Natural Heritage Information Centre. Consultation with local naturalists, OMNR staff, scientists, and academics can also help the planning authority obtain relevant information on the area to be investigated.
- Determine specific priorities for site visits (e.g., to assess the nature and level of disturbance on specific portions of the site, to describe the ecological features of the rare habitat, to determine species presence)
- Provide a schedule for the field investigations that ensures that the required information can be obtained at the time(s) of year. For example, to evaluate the significance of a migratory shorebird stopover area, field workers will want to be present at peak periods when the greatest number and diversity of shorebirds will be observed on the site. Most wetland community identification and evaluation is better done in July and August because most wetland plants flower later than most plants of terrestrial/upland communities. Most breeding bird observations should be done between late May and the end of July, but observations of raptors and waterfowl breeding should be done in April and early May. Different seasonal timing is required for amphibian breeding, flowering plants, deer yards, etc.
- Provide operational guidelines for any field investigations on private property

Field Investigations

- Assemble the necessary materials for work in the field. These include topographical maps (1:50,000 scale), Ontario Base Maps (scale 1:10,000, 1:20,000 in the north), aerial photographs (scale 1:10,000, 1:20,000 in the north) of the site; a compass adjusted for declination of the area; information about the site (e.g., existing species checklist, community maps); clipboard with sheets of Mylar; field notebook or small tape recorder; pencils, eraser, sharpener; and miscellaneous equipment such as binoculars and field guides.
- Have a list of basic information to record as field notes or observations. This list usually includes the following information: approximate size of site; level and type(s) of disturbance on the site or within specific communities; diversity of site (vegetation composition and structure, floral and faunal diversity; special or unusual ecological features of the site), and a description of as many site conditions as expertise permits (aspect, slope, soils texture, drainage, moisture regime, microclimates etc.).
- Prior to undertaking fieldwork, take a photocopy of the pertinent aerial photos (use the photo enhancement capability of the photocopier). If the planning authority has the capabilities, it is very useful to scan the aerial photos and print them off to take into the field. Original aerial photos may be used in the field, and erasable grease pencils may be used to write on them. If none of these facilities are available, an overlay of Mylar on the aerial photographs may be useful. Mark on the field map/photos the sites to be visited, your present location, and the location of your parked vehicle. Recording this information before entering the area to be investigated makes it easier to keep track of your location.
- On most aerial photographs, north is found at the top of the photograph, and 1 cm on an aerial photograph is roughly equivalent to 100 metres in the field at a scale of 1:10,000 and 200 m at 1:20,000. Field workers should measure their pace to determine approximately, how many steps are taken to cover a measured distance. This knowledge can provide a reasonable estimate of the distance covered on foot in the field, help field workers know where they are, and even provide rough estimates of the size of areas covered on foot.
- Keep track of your location on the site in order to accurately describe and map it. On sites greater than 100 hectares, pay constant attention to the maps, aerial photographs and compass bearings. Use a compass and prominent landmarks, preferably ones that are visible on both aerial photographs and maps (or at least on aerial photographs) as reference points to travel to desired points of interest. Be sure to record all compass bearings, these reference points, and approximate distances travelled, in a field notebook or on a small tape recorder. For future reference and any mapping, it also helps to sketch simple maps in a field notebook, noting due north and any prominent landscape features.
- Use triangulation to find out where you are in an unfamiliar area. To do this, first locate two recognizable reference points on the distant landscape that are also visible on the aerial photograph (or map). Take bearings from your position to one of these landmarks. Place the compass on the aerial photograph, with the cover opened wide so that the long edge intersects the landmark and the cover is towards the landmark. Rotate the compass edge about the landmark until the parallel meridian lines on the compass are roughly parallel with the vertical edges of the aerial photograph (or meridian lines of the map) and fixed North indicator on the rotating bezel (not the compass needle) is on the North side of the aerial photograph or map. Then starting from the landmark, draw a line on the aerial photograph or map, along the edge of the compass. Repeat this for the second visible landmark. The intersection of the two lines is your position.
- Consider using photography to help further document the overall character, unique features and various communities of the site, for future meetings and discussions.

The above discussion focuses on material and background information to take to the field, and how to determine where one is. It does not provide any information on how to actually collect pertinent data. In many instances, planning authorities may not have in-house expertise for collecting field data and may have to hire consultants or rely on proponents to provide relevant data. There are, however, some planning authorities that have their own environmental staff or that have agreements with conservation authorities or other conservation groups.

Following are some general guidelines for conducting fieldwork for specific natural features:

- A basic requirement is identification of habitat types. The most recent version of the Ecological Land Classification system for southern Ontario should be used (Lee et al., 1998). Similar classification systems are available for the north. Personnel completing this analysis should be capable of identifying tree species, dominant species that occur in the understory, and have an understanding of soil properties.
- A qualified botanist is usually required to identify plant species and also their habitat requirements and the amount of habitat that should be protected to ensure their continued survival in the planning area. It may be necessary to conduct fieldwork during early spring, summer, and early autumn to ensure that most species have been detected (there is no such thing as a "complete inventory").
- The Canadian Wildlife Service has prepared protocols for monitoring amphibian populations. These are not very useful when working on a site-specific basis. However, they do provide a tape so that one can identify the songs of calling frogs.
- There is no standard protocol for sampling reptiles. For snakes, when a species of conservation concern may occur in the planning area, distributing hiding sites may give an excellent indication of where these species occur. Placing boards and other cover may reveal the location of species and give an indication of their relative abundance.
- For breeding birds, there are several standardized techniques. Fieldworkers should be able to identify birds by song and visually. For most birds, the breeding season extends from very late May until the first week of July. Surveys should be done starting shortly before dawn and ending by 0900 or 1000 at the latest. Calm days with no rain should be selected for surveying. Shorebirds, waterfowl, and raptors nest earlier through April and May. For difficult to detect species (marsh birds, certain hawks, owls) tapes of their calls may be played to elicit a response. There are also special protocols for sampling marsh birds, certain owls, and Red-shouldered Hawks.
- Most mammal observations rely on checking for signs such as tracks, scats, dens, etc. When surveying for a specific species, it is necessary to know its habitat requirements before designing the field methods. Appendix G gives the general habitat requirements of the mammals that occur in Ontario.

APPENDIX E

Natural Heritage Gap Analysis Methodologies
Used by the Ontario Ministry of Natural Resources

This appendix was prepared as part of the Living Legacy (Lands for Life) exercise. The methodology was first developed and described as an efficient method for identifying unrepresented or under-represented natural heritage features within an area of interest. However, the principles described for gap analysis can be applied province wide or can be applied to the site district scale as criteria can be added to apply gap analysis to a finer scale.

Natural Heritage Gap Analysis Methodologies Used by the Ontario Ministry of Natural Resources

(DRAFT 25 January 1999)

William J. Crins and Philip S.G. Kor
Open File Natural Heritage Technical Report 9901
January 1999

Ontario Ministry of Natural Resources
Lands and Natural Heritage Branch
Natural Heritage Section
Peterborough, Ontario

1.0 INTRODUCTION

The goal of the Natural Heritage Areas Program is "*to establish a system of protected natural heritage areas, representing the full spectrum of the province's natural features and ecosystems*" (OMNR 1997). For life science features, this goal is achieved through an assessment of the landform/ vegetation associations in each Site District, and the selection of a set of natural heritage areas that best meets a set of five selection criteria. For earth science features, the goal is accomplished through the development of environmental themes identified by the record of Earth history in the rocks, landforms and geological processes, both past and present, of Ontario.

The best representatives of the life science and earth science features are denoted as provincially significant. Protective zoning designations in Provincial Parks (Wilderness, Nature Reserve, and Natural Environment zones), Conservation Reserves, and Areas of Natural and Scientific Interest (ANSIs), taken together, provide the mechanisms by which the natural heritage features of each Site District or earth science theme are represented and protected. The focus in site selection is on the best representation of the natural diversity of the Site District or earth science theme. In the case of life science values, both living and non-living components must be assessed; hence, the setting of representation targets is based on combinations of landforms and vegetation.

2.0 LIFE SCIENCE GAP ANALYSIS

Gap analysis, in the conservation biology context, refers to an approach (or a set of methodologies) for setting and filling natural heritage targets. It facilitates the identification of features that are unrepresented or under-represented within a natural heritage areas system. Different approaches have been used in different jurisdictions, but the underlying premise is common to all approaches: natural heritage features are assessed to determine whether or not some of those features require conservation.

The purpose of this chapter of the document is to outline the current life science gap analysis methodology employed in Ontario, and to outline the application of the five site selection criteria. In this province, the primary objectives of life science gap analysis are the assessment of the conservation status of the naturally occurring landform/ vegetation associations of each Site District, and the identification of the best representative areas that together contain the full array of these associations. The selection of the representative areas must be conducted using as rigorous and objective an approach as is possible with qualitative or semi-quantitative site selection criteria.

While being cognizant of the principles of conservation biology, as well as current dialogue regarding the concept of 'biological integrity', the selection of areas must be accomplished within the scope of existing policies and principles. The methodologies described here serve to identify core representative areas only, in as efficient a manner as possible. Resource management activities on the intervening lands must be conducted in a manner that does not compromise the values of these core areas, thereby contributing to the ecological sustainability of these core areas as well as of the landbase as a whole.

The objective of selecting the best representative sites carries with it the need to identify parts of the landscape that have been subject to limited recent human disturbance. The objective of identifying the best remaining examples of each landform/ vegetation association in a Site District means that, on occasion, relatively small remnants will be identified, although in other cases, large aggregations or assemblages of features will occur together. No assumptions about minimum size requirements have been applied *a priori*. Rather, the methodologies focus on the identification of the best examples of what exists. Restoration of areas and their component features, and other conservation biology objectives, potentially can be added to the system in the future, but to avoid arbitrariness in site selection, the search for sites begins with the undisturbed or least disturbed areas.

Most gap analysis projects that have been conducted in various parts of the world have focused on life science features, and in particular, species and habitat representation. Almost all jurisdictions applying gap analysis have used a broad landform template, and some have superimposed habitat or vegetation onto that landform template. Most of the variation in approach occurs in the template on which natural heritage features will be assessed (landforms, soils, vegetation types, species, geographic units, etc.), in the resolution of the targets, and in the determination of adequacy of present conservation of the natural heritage values. The approach used by the OMNR is outlined below.

2.1 General Approach for Life Science Gap Analysis

OMNR's gap analysis method consists of four steps:

- Identifying landform features (coarse filter)
- Identifying vegetation features on each landform unit (fine filter)
- Assessing existing representation
- Identifying the gaps

Step 1: Coarse filter - landform units (enduring features)

For the ecological district being studied (in Ontario, the Site District is the unit of study), available landform maps are examined. Surficial geology, bedrock geology, and combinations of these themes, can be used to delineate the landform patterns of the district. Mapping at a scale of 1:250 000 is suitable for analysis at the Site District scale. Sources such as the biophysiographic mapping produced by Noble (e.g., 1982, 1983) have been used in central Ontario. They were produced through interpretation of surficial geology, the biophysiographic units essentially consisting of aggregations and/or refinements of Ontario Land Inventory (OLI) units, taking account of mode of deposition, major and minor overburden, and ruggedness or irregularity of the terrain. These maps are somewhat similar conceptually to the physiographic mapping produced by Chapman and Putnam for southern Ontario (1984), although produced at a somewhat finer scale.

All landform units within the Site District are tabulated in this first step of the method. The finest level of resolution in Noble's biophysiographic unit classification system is used (i.e., Ia-1 and Ia-4 are considered to be different biophysiographic (landform) units).

OLI units may also be suitable for use at this stage of the analysis, but may require some preliminary aggregation of units, to make them comparable to Noble's units. All landform units recognizable at 1:250 000 scale within the study area are tabulated and mapped in this step. Other alternative landform systems could include Chapman and Putnam's system (1984) or soil surveys for the south, a combination of the bedrock geology and surficial geology coverages produced by the Ontario Geological Survey, or the Northern Ontario Engineering Geology Terrain Study (NOEGTS) coverage in the north. However, some of these coverages are at a coarser scale than OLI or Noble's coverages (with lower resolution), and therefore, are less preferable.

Step 2: Fine filter - vegetation response to landform

Using available databases, reports, and literature, the natural vegetation types known to occur within the Site District are summarized, and are correlated with the landforms examined in Step 1. This may be accomplished by manual overlays of the landform units with vegetation mapping (e.g., Forest Resource Inventory [FRI] maps or classified LANDSAT imagery). However, ideally, gap analysis should be conducted in a Geographic Information System (GIS) environment, where large data sets can be overlaid, analyzed and summarized much more efficiently. In section 2.5 of this document, a step-wise analytical procedure is described for the completion of gap analysis in a GIS environment.

Overlaying the landforms and vegetation types results in tabular and cartographic outputs for each landform/ vegetation unit created within the study area. When FRI is used, the working group (generally, the dominant tree species) serves as a convenient level of classification for forested vegetation types. These are further subdivided by three broad age classes (see Appendix I). Thus, for forest vegetation types, representation targets consist of young, medium-aged, and old forests of each dominant tree species in each Site District. Summary statistics for each vegetation type and age class on each landform unit can be produced.

In all cases involving the use of FRI data as the vegetation coverage, the codes representing rock outcrops and wetland types can serve as a coarse classification system (albeit far from ideal) for non-forest vegetation types.

Step 3: Assessing existing representation

Examination of landform/ vegetation complexes in existing protected areas including protective zones within Provincial Parks (e.g., Wilderness, Nature Reserve, Natural Environment), National Parks, and other land designations (e.g., Conservation Reserves) is undertaken to determine which landform/ vegetation features are currently protected. Only those areas regulated or zoned specifically for natural heritage protection are factored in to the assessment of existing representation.

The landform/ vegetation features occurring within existing protected areas are compared with the landform/ vegetation features found in the Site District as a whole (Step 2, above). The comparison of existing protected landform/ vegetation types with those known to occur in the Site District yields the unfulfilled representation targets, or gaps, that still require inclusion and protection in the natural heritage areas system. In the GIS version of gap analysis, guidelines are applied to ensure that features contained within inappropriate park classes or zones (e.g., Recreation and Historical Parks; Access, Development, Historical, and Recreation/ Utilization Zones) are not considered to be represented. These guidelines do not address the question of adequacy of representation, but simply provide a means of excluding features contained within developed or otherwise disturbed parks and protected areas that might otherwise be factored into the existing representation calculations. In the manual version of the method, these classes of parks and types of zones would be ignored when considering existing protection.

Step 4: Filling the gaps

Landform/ vegetation features that are not yet represented in the natural heritage areas system serve as the focus for the search for new areas to fill those gaps. The focus of the method is to identify suitable sites to fill the representation gaps. Selection criteria for new sites conform to those used in existing OMNR natural heritage programs (Parks systems planning, ANSI program). These include: representation (the basis for gap analysis, including broad age-class representation of forest types), diversity (the number of different landform/ vegetation features within a given area), condition (the degree to which anthropogenic disturbance has occurred), ecological considerations (e.g., local hydrological/ watershed functions), and special features (presence of populations of vulnerable, threatened, and endangered species, localized or unusual features). The application of these five selection criteria allows for the assignment of relative significance levels to each example of the unrepresented features (e.g., provincial, regional, or local significance), taking into account the surrounding landscape (other adjacent unrepresented features, nearby special features, hydrological characteristics, etc.).

FRI or LANDSAT databases and landform maps serve as the background in which the search for unrepresented features occurs. Previous disturbance of the landbase by human influences (logging, mining, road-building, hydro development, agriculture, settlement) reduces the value of certain portions of the landbase for the achievement of natural heritage representation targets. Thus, such disturbances are taken into account in the search for areas to represent required features. OMNR District/ Area Offices are canvassed for cut-over maps and other information relevant to the determination of impacts on the landbase. Other sources of disturbance information may also be sought out and used, including information held by resource-based companies, planning authorities, other agencies, etc.

The entire Site District is scanned for potential representative areas. Each area that is still relatively intact, in the sense that it does not contain extensive cut-overs, road networks, or other developments, is compared with respect to the landform units and forest types (working groups and age classes) that it contains. An assessment of diversity within a block (relatively undisturbed portion of a Site District) is made on the basis of the number of landform units, working groups, and broad age classes, since other site-specific measures of diversity may not be available, especially in the north. Other parameters relevant to the five selection criteria also are assessed, including juxtaposition with existing protected areas, hydrological features, size, and special features. Since very little information is available on special features in many parts of Ontario, this criterion often cannot be applied with any rigor, but when information is available, it can be used to compare otherwise similar areas.

The final result of the gap analysis is a set of provincially significant areas that, taken together, provide the best representation of the array of landform/ vegetation associations known to occur in the Site District. It also results in the identification of additional sites that fulfil all or some of the selection criteria, but that are not deemed to be the best representatives. These sites are assigned lower levels of significance (regionally or locally significant).

2.2 Site Selection Criteria

Five site selection criteria are employed to assist in the determination and delineation of provincially significant sites. These are: 1) representation, 2) condition, 3) diversity, 4) ecological considerations, and 5) special features.

Landscape-scale Criteria

1) Representation

Ontario's approach to life science gap analysis can be considered to be a 'feature-representation' approach. The method attempts to identify the 'best' examples of all landform/ vegetation features (given the set of selection criteria described herein), thereby representing the full array of these features. This approach recognizes the reality that some landscapes are more diverse than others, without assigning a given percentage target, and also acknowledges that the land use history differs among landscapes and/or landform units. As Harris (1984, p. 109) notes "... *the question of how much is enough can only be fairly addressed in the context of surrounding forest conditions.*"

The most important selection criterion is representation, since the entire natural heritage areas system is based on the principle that the areas containing the best representatives of each landform/ vegetation complex are to be conserved, if possible. If an area does not contain a high-quality example of at least one landform/ vegetation feature, then it should not be considered further, in this context. However, determination of the best representative examples may require comparisons among several potential alternatives, and this is where the additional selection criteria become necessary.

2) Condition

In the gap analysis method described above, the landbase under consideration for contribution to representation is screened by considering existing and past land uses (but not proposed future uses), including cut-overs, road networks, mining areas, other unnatural corridors (hydro-lines, railways, etc.), agricultural areas, settlements, and other types of development. In effect, condition, or the degree of anthropogenic disturbance, has already been used as a selection criterion at this point. Potential sites for consideration as natural heritage areas are screened early in the selection process for their relative condition or quality.

Local-scale (Site Comparison) Criteria

Sites that remain under consideration after the Representation and Condition criteria have been applied must be compared using the remaining three criteria. Because there is often a lack of information about special features (populations of rare, threatened, or endangered species, unusual or localized geological features or habitats, etc.), especially on the Precambrian Shield, the special features criterion is best used as a supplementary or supportive one. Thus, all else being equal with regard to representation and condition, the diversity and ecological considerations criteria can be used to determine which of several sites should be regarded as the best site for a given feature or set of features.

3) Diversity

A site is considered to be more diverse than another if it contains more high-quality, representative features. Diversity can be achieved at several scales. However, in the landscape (Site District)-scale gap analysis, assessments of diversity are made at the landform and vegetation community scales, rather than at the species scale. In most cases, species richness is unknown in these sites anyway. Thus, a site that straddles several landform units will be more diverse than a site that is entirely confined to one unit. If the sites being compared are all situated on a single landform unit, then, again all else being equal, the site with the greatest range of vegetation types is preferred. If information sources permit (e.g., FRI data), age-classes within vegetation types also are considered in the assessment of relative diversity. This is done by using broad age classes, defined for each forest vegetation type (see Appendix I). At the present time, there is no method for determining the effects of past logging (particularly when removal of single or a few species was involved) or human-induced fires on age-class structure of the current forests. Thus, the approach taken here is to consider the existing forest, taking account of as much information on forest disturbance as possible.

Unfortunately, most databases available for use in life science gap analysis in Ontario do not do an adequate job of classifying non-forested vegetation types. Nevertheless, an attempt also should be made to consider rock outcrops, shorelines, non-treed wetlands and other non-forested vegetation types in the assessment of diversity, even if only broad categories and presence/absence can be determined.

4) Ecological Considerations

Ecological considerations relate to such attributes as hydrological functions and connectivity (aquatic and terrestrial). An area that provides natural, biologically meaningful connections with other nearby significant areas, or an area that contains headwater lakes, ponds, springs, or streams, will fulfill this criterion. Limiting components of habitat, such as important moose aquatic feeding areas, bat hibernacula, spawning beds, etc., could also fulfill this criterion.

These features are used to refine boundaries where they occur in close proximity to the core representative features. They also may be used to distinguish among areas that otherwise are similar in their representation, condition, and diversity.

5) Special Features

Special features include populations of rare, threatened, or endangered species, and unusual or localized geological features or habitats. Some parts of Ontario are extremely rich in such information (e.g., southwestern Ontario). However, in other areas, there is a lack of information. This lack of information may be due to difficulty of access or limited survey effort, rather than an actual absence of these features. Therefore, this criterion is best used in a supplementary or supportive role. Areas should not necessarily be penalized or downgraded if they lack special features, unless areas against which they are being compared do contain known special features. The Natural Heritage Information Centre is a primary repository for data on special features.

2.3 Step-wise Methodology for Life Science Gap Analysis

This section outlines an algorithm for data analysis which results in the identification of representative core areas that, taken together, will contain the full set of landform/ vegetation features found in a given Site District.

Part 1 - assessment of unrepresented features, and options for filling gaps:

- For each Site District, overlay landform and vegetation layers;
- Summarize proportions and amounts of each landform unit within the Site District (output=table);
- Summarize proportions and amounts of each FRI Working Group by three broad age classes (Appendix I), on each landform unit (output=table); each Working Group age class equals a vegetation type;
- Overlay existing Protected Areas layer;
- Summarize proportions and amounts of landform/ vegetation types for existing protected areas (output=table);
- Subtract landform/ vegetation types found in protected areas from total set of landform/ vegetation types in Site District; produce table of unprotected types.

Rules for determining minimum levels of representation in protected areas:

- At least 50 ha of any landform/ vegetation feature must be contained within a protected area in order to be considered represented, at this stage in the analysis;
- At least 1% of each landform/ vegetation feature must be contained within the suite of protected areas in the Site District in order to be considered represented, at this stage in the analysis.

- Overlay disturbance layers for Site District;
- Remove disturbed areas from Site District land base;
- Identify all areas having unprotected landform/ vegetation types (polygons), subject to the minimum representation rules applied above;
- If there are landform/ vegetation types within the Site District that do not occur in undisturbed areas, re-examine the disturbed landbase for those types; examination of the disturbed areas may occur in a step-wise manner until suitable polygons are found;
- Delineate clusters of contiguous unprotected landform/ vegetation polygons, including single polygons;
- Tabulate and sum the number of polygon types in each cluster; produce a table summarizing the numbers, types and sizes of polygons for each cluster;
- Overlay Special Features data, where available, for the Site District;
- Produce a map of clusters, using the above layers, including labels in hard copy and digital formats, and categorize the clusters on the map according to the number of unrepresented features contained in them - the digital file will be the plot file used to create the hard copy map.

Part 2 - identification of "best" representative areas:

Using an iterative approach, identify those clusters that, together, best represent the features not yet represented in protected areas within the Site District. This will be accomplished by searching for the clusters that contain the most unrepresented landform/ vegetation features, subject to the minimum representation rules noted above.

- Select the cluster identified in Part 1 that contains the most unrepresented landform/ vegetation features, subject to the minimum representation rules used above (50 ha and 1%);
- Subtract the features contained therein from the list of unrepresented features in the Site District;
- Select the next cluster identified in Part 1 that contains the most unrepresented landform/ vegetation features from the revised list, subject to the minimum representation rules used above (50 ha and 1%);
- Subtract the features contained therein from the revised list of unrepresented features in the Site District;

Continue this iterative analysis until all landform/ vegetation features are represented in a set of areas.

Part 3 - option development:

The same approach as outlined in Part 2 can be used to identify optional representative areas, if needed, for planning purposes.

- Re-do the above iterative analysis, using the clusters that contain the second largest set of unrepresented features, assuming that the sites containing the most unrepresented features cannot be protected;
- Re-do the above analysis, using the clusters that contain the third largest set of unrepresented features (development of planning scenarios).

2.4 Assumptions

The life science gap analysis approach described here requires several assumptions. The over-riding assumption implicit in this methodology is that the Site District (ecodistrict) scale is the appropriate scale at which representative features should be selected to build a natural heritage areas system. This assumption also rests on the selection of the Ecological Land Classification (ELC) system originally designed by Hills (1959), and modified by others (e.g., Burger 1993, Jalava *et al.* 1997), as the template within which these gap analyses would be conducted. Arguments for coarser and finer scales of resolution have been made, but the Site District scale has stood the test of time in Ontario (it has been used for over 20 years for the purpose of establishing and meeting natural heritage targets), and it provides a useful scale for the determination of major ecosystem attributes and dynamics. A coarser scale (e.g., Site Region or ecoregion) forces too much generalization. The substantial variation that exists in ecosystem composition, structure, and function across an ecoregion is not well reflected when natural heritage areas are selected at this scale, assuming that the approach described in this paper is used. A finer scale of resolution would be difficult to apply in most parts of Ontario, because of the lack of ecosection definition and mapping (however, this may become available in the near future), and the limited data available on detailed distributions and specific habitat requirements of most species.

In the present approach, it is assumed that landform/ vegetation associations serve as adequate surrogates for ecosystem components, especially relating to habitat. The method attempts to identify potential natural areas on the basis of aggregations of these landform/ vegetation associations, so that at least some of the natural areas will contain diverse assemblages of habitats and associated species.

Another inherent assumption is that undisturbed or least disturbed examples of the landform/ vegetation associations are better, from a conservation point-of-view, than more severely disturbed examples of those same associations. This assumption has as its premise that relatively undisturbed examples of ecosystems are more likely to contain and support the full range of compositional, structural, and functional attributes of those ecosystems. Thus, they provide the best available samples of those ecosystems.

The limitations of the data sets that are used in the life science gap analyses in Ontario (see Sect. 2.5) require that assumptions be made about several types of ecosystems (particularly non-forested, wetland, and aquatic systems). Since the data sets do not contain adequate classifications for these community types, reliance must be placed on very broad categorizations (e.g., 'rock' in the FRI data set would include natural rock barrens, cliffs, alvars, etc.). By including samples of such non-forested categories from each landform type, it is assumed that the range of ecosystems in these categories can be represented in the set of sites selected in the Site District.

The gap analysis method described here uses the concept of efficiency in an attempt to identify a set of areas that represents the landform/ vegetation diversity of a Site District. Thus, areas are selected based on their relative diversity, with the areas containing the most remaining unrepresented landform/ vegetation features selected at each iteration. It is assumed that more diverse areas generally will support more ecological functions, and contain more habitats and species. More diverse sites also tend to be larger, although this is not always the case.
Perhaps the most important assumption, in terms of application of this methodology, is that the remainder (bulk) of the landbase is being managed on an ecologically sustainable basis. This means that, for example, appropriate silvicultural approaches are being used in the forests adjacent to these sites, that guidelines conserving non-timber values are being applied, and that natural patterns are being emulated in resource planning and management activities.

The methodology, as presently designed, focuses on core representative features, with boundaries designed to account for local hydrological, topographic, and special features. There are no provisions for additional 'buffers', because it is assumed that activities on the adjacent lands will not be detrimental to the values of the core areas. This assumption clearly does not hold true in the settled parts of Ontario, but there, natural heritage core area design is constrained largely by adjacent land uses that have removed the natural or near-natural vegetation cover. Other approaches, including restoration activities, would be required to enhance the integrity of the core areas in such landscapes. In the less densely settled or developed parts of the province, forest management can be planned and conducted in an ecologically sustainable manner, through the application of guidelines and silvicultural approaches that maintain forest types that are adapted to the local site conditions. Thus, ecological functions including nutrient and water fluxes, gene flow, and various other components of population genetics and dynamics, can be maintained across the actively managed - protected area boundary interface. The 'edges' in properly managed landscapes containing core protected areas should be soft edges, not sharp discontinuities.

2.5 Limitations

In conducting gap analyses in Ontario, it has been necessary to use data sets that may have been compiled for entirely different purposes. This is because they may be the only data sets available that can provide the necessary thematic information (vegetation, landforms, disturbances, etc.). The various data sets also have been compiled or interpreted at varying scales, so there is the potential for inaccuracies to occur when these data sets are correlated or overlaid. This problem has been addressed, in part, by the exclusion of 'slivers' (landform/ vegetation features less than 1 ha in size) from consideration when assessing the diversity of potential representative areas. Nevertheless, there is still the potential for artifacts when overlaying data sets with different scales of accuracy.

Two existing data sets have potential applicability for the vegetation component of life science gap analysis. These are classified LANDSAT TM imagery, and the Forest Resource Inventory (FRI). Each has advantages and disadvantages. The current classified LANDSAT data set does not provide adequate resolution of many vegetation types. For example, it is not possible to distinguish between spruce species, nor among intolerant hardwood species, nor is it possible to distinguish between ecotypes of a particular species (e.g., upland versus lowland Black Spruce). This is possible to some degree with FRI, by examining the stand composition, and understanding the ecological preferences of the species associated with Black Spruce. Neither LANDSAT nor FRI data sets classify non-forested lands adequately. However, the FRI does contain general categories for rock outcrops and various lake and wetland types. These categories generally are inadequate for natural heritage analysis purposes. Thus, it is necessary to make assumptions about non-forested vegetation communities that may be included within the sites recommended for protection in gap analyses using these data sources. In any event, it would be preferable to have data sets that are more ecologically based. A province-wide classification of ecosections and ecosites would be ideal for gap analysis purposes, and would provide the necessary analogs to the present landform/ vegetation approach.

Another limitation of the vegetation data sets is that they are interpreted, although both data sets have had some degree of ground-truthing. There has been greater emphasis placed on refining the FRI data set on Crown Land, through additional timber cruising, than there has been on private land, although even on Crown Land, the focus always has been on commercial tree species. Also, the age of the actual FRI data varies from area to area. This is also true for disturbance information, such as cut-over information. Up-to-date forest history data (cut-overs, roads, etc.) often exist only in paper (not in digital) form, although some of these data are available in the LANDSAT and FRI data sets. Often, it is necessary to update disturbance coverages by digitizing the newer information, and by vetting the results of gap analyses with knowledgeable staff from the district and area offices. It may be necessary to revise the boundaries of proposed protected areas in the light of these additional disturbance data.

The method focuses on existing diversity. There has been no modeling of previous landscape structure and composition. Therefore, it is possible (likely in some areas) that some landform/ vegetation associations that may have occurred in the past are not included in the sets of sites identified using the current methodology. Future research in natural heritage area systems should include modeling of past ecosystem distribution. Such work could then enable the identification of ecosystems in need of restoration, and suitable locations for such efforts.

Ideally, gap analysis should be conducted with proper spatial analytical tools, such as a Geographic Information System (GIS). Manual analysis of data sets is possible, and has been employed in the absence of the necessary digital data sets, but it is extremely time-consuming and inefficient. However, even with GIS, the size of some of the data sets to be analyzed, especially for the larger Site Districts, can stretch the capabilities of the existing technology.

Several steps in the automated methodology outlined in Section 2.3 have potential limitations that require further consideration and development in the future. The rules with regard to minimum levels of representation in existing protected areas and new candidate sites (50 ha and 1% of the landform/ vegetation feature within the Site District) were designed to ensure that features within inappropriate areas (e.g., Recreation class parks) were not considered to be representative. This does not mean that these minimal levels are adequate for representation. They should be considered for what they were intended to be, minima. Adequacy of representation is an issue that has no resolution at the present time. Adequacy will depend, in part, on the dynamics of the ecosystem being considered, and also on the nature of the land uses adjacent to, but outside of, that ecosystem. Thus, again, with the methodology described here, it is critical that ecologically sustainable resource management occurs outside of the protected core representative areas.

The GIS-based algorithm relies on the contiguity/ adjacency of polygons containing unrepresented landform/ vegetation features when identifying clusters and assessing diversity within those clusters. Thus, breaks in the landscape, whether they are based on features that are already represented, on disturbances, or on other types of polygons that are not classified or not factored in as features for representation, will serve to limit the sizes of the clusters identified as being potential representative core areas. Most of these breaks in the landscape are consistent with the approach of identifying core areas for protection using landform/ vegetation diversity and efficiency assumptions. However, water bodies also cause breaks in the landscape. Ideally, the system of representative areas would include the full array of aquatic ecosystems, as well. The ecological considerations selection criterion assists with this. Nevertheless, water bodies (including lakes, ponds, and large rivers) are not treated as targets for representation up-front in the current methodology, and must be factored in once the clusters have been identified. This also means that water may break clusters that might otherwise have been combined. A method is being developed to minimize this effect, but it is only partially successfully at present, and therefore, it is still necessary to assess this effect manually after clusters have been generated.

Although the present GIS-based algorithm accounts for numerous combinations and permutations in the available data sets, given the current approach to representation, it seems likely that there will always be a need for informed judgment by specialists after the results of any gap analysis have been obtained.

Since gap analysis is extensive, dealing with large land bases, field inventories likely will be limited. However, the results of gap analyses will always benefit from field visits to the sites, even if these occur at some time after the analyses are completed, for the purposes of confirming the results, providing additional details on the vegetation communities of the sites (particularly with regard to understorey species and non-forested communities), and acquiring data on special features. It is possible that boundary revisions may be warranted at such time as site-specific inventories are conducted, or as information becomes available, either from staff or from members of the public who may visit these sites.

Most of the information on populations of rare, threatened, or endangered species is found in OMNR files, and in the north, much of it relates to a few "featured species", such as Bald Eagle. Virtually nothing is known of the botany of large portions of the province. The Natural Heritage Information Centre contains the most comprehensive data sets for rare species, and is constantly updating its data sets, but data for northern areas are still limited.

3.0 EARTH SCIENCE GAP ANALYSIS

3.1 Background

In 1978, a revised Parks Policy established a goal and objectives for Ontario's Provincial Parks. One major objective of the policy is: "*to protect provincially significant elements of the natural and cultural landscape of Ontario*". This objective was to be satisfied through a system of parks and zoning (now expanded to include Conservation Reserves) founded on the principles of representation, variety and permanence. The policy guideline articulating the Ministry's protection objective as applied to geological component of the natural landscape is: "*to protect a system of earth science features representative of Ontario's earth science history and diversity*".

Earth science features are defined as the physical elements of the natural landscape, created by the earth's processes and distinguished by their composition, structure, and internal and external form. Earth science conservation is the recognition of the significant elements of the natural landscape and their protection from undue alteration by man's activities. Gap analysis is a term recently coined of a comparative evaluation process which seeks to achieve representation of these elements in a system of protected areas. This section explains the gap analysis process as used for earth science conservation.

The protection of geological and landform elements of the landscape has a long history in Ontario, and was formally recognized in policy as early as 1959. The presented gap analysis process has been in use in Ontario since the early 1970s (Beechey and Davidson 1980; Davidson 1981, 1988), although the term "gap analysis" has only recently been applied to the process. Earth science conservation is becoming increasingly recognized within the context of international environmental circles.

3.2 Earth Science Conservation

To satisfy the Provincial Parks Policy's earth science guideline, a framework, or model, was needed to guide the selection of features. The resulting document, informally called the *Earth Science Framework* (Davidson 1981), essentially a synthesis of the geological history of Ontario, outlines the geologic themes and features which are targeted for representation in a system of protected areas.

Earth science conservation (also known as earth heritage conservation, or geological conservation) concerns the protection of selected, representative features of the province's geological history and its physical expression on the landscape in a system of protected areas, and the monitoring of the remainder of the physical land base to provide alternate sites for scientific and educational opportunities. Earth science gap analysis is a selection process which determines the existing and required levels of representation of the earth sciences in Ontario. Earth science gap analysis identifies the features which are unrepresented or under-represented within a system of protected areas, and identifies sites where features of the geological history, landforms and processes in Ontario will address the completion of that representation.

The objective of the earth science gap analysis process is the identification of the representative features of the province's physical landscape that best define its past and present environments. These environments are interpreted through scientific study of the province's rock record, surface morphology, and geologic processes active in the past and present. In order to determine what features are most important to be set aside, it is necessary to describe the earth science diversity of the land base and to determine the most significant elements essential to the description of that diversity.

The classification of earth science diversity is based on internationally recognized (if not always agreed to) concepts of time, landform evolution (geomorphology) and geologic process. The earth sciences encompass a range of interconnected but quite distinct subdisciplines which together help to explain how Earth formed and changed through time, at depth and at the surface. Earth science representation attempts not only to identify an example of all the known geological features in the province (rock types, fossil assemblages, landforms and geological processes), but also to identify a suite of features which define the significant geological events through time. This time aspect of geological representation is found in the rock record by its lithostratigraphy, in the fossil record by its biostratigraphy, and in the landform record by its morphostratigraphy. Thus earth science representation seeks protection of the elements of the physical makeup of the province, as well as protection of complexes of the physical features of the province that define the passing of geologic time.

In the bedrock record, the protection target is to identify one best representative example of each rock (lithological) type from the full range of identifyable units that we know to occur in the exposed rock record (lithology). In addition, the protection target is to identify examples of each discrete period of time within the sequence of events in the geologic time scale as represented by individual rock units (lithostratigraphy). This inevitably results in the duplication of rock type representation, because of the inherent cyclicity in geologic processes over time .

A similar approach is required for the representation of landforms, which, in Ontario, are predominantly glacial in origin. Representation targets consist of the identification of the best examples of each landform (and its derivatives) that occurs in the province, as individual features (i.e., esker, moraine, drumlin, kame, etc.), and, the identification of landform features which best reflect the major events in the (in this case) glacial history of the province (morphostratigraphy).

The ancient geologic processes which have shaped the province are reflected in the rock record, fossil record and landform record of the current landscape. Representation of these processes is achieved largely through the identification of sites noted for their values in representing chronology and stratigraphy. Representation targets for modern geological processes, such as lakeshore, fluvial and aeolian processes, constitute those sites which best display the current actions of a selected process and its resulting landform(s).

To accommodate the range of geologic time, stratigraphy and landform in the province, the geologic record in Ontario has been classified into 43 **environmental themes** , each of which represents a particular, interpretable environment of formation. Each environmental theme is characterized by a set of features, or elements, of the physical landscape, be it in the rock record, the fossil record, or the landform record, that defines a set of conditions of formation, or environment. In this way, each environmental theme is distinguishable from adjacent themes. The environmental themes are tied closely to the geologic time scale, in that each theme represents a set of conditions known to occur during a particular time period of earth history. Examples of environments that helped shape the landscape and that are accompanied by physical evidence, are periods of mountain building, periods of profound erosion, the incursion of warm tropical seas, the impact of extraterrestrial objects on the earth's surface, and periods of glacial activity. The elements of each of these themes, that is, the features which serve to characterize the environment which identifies each theme, make up the representational targets of the gap analysis process. The environmental themes used in Ontario are defined and described in the *Earth Science Framework* (Davidson 1981).

The scale of representation of the elements of an environmental theme varies considerably. Individual outcrops of bedrock or unconsolidated sediment are generally small, less than 1 hectare in size . Individual landforms and some process themes may only need a few 10s of hectares to adequately represent enclosed features . Larger landforms, and associations of landforms, may require many 100s of hectares to adequately represent the identified features . The representation of active geological processes often encompasses large areas , sometimes requiring the management of areas beyond the specific identified element(s) in order to assure the continued natural functioning of the identified process(es).

Because of the wide range of scale in the types of earth science features evaluated, no assumptions about minimum size requirements have been applied *a priori*. There are np upper or lower limits set on the amount of land to be protected for earth science features because there is no scientific basis for setting such arbitrary limits. Rather, the methodologies focus on the identification of the best examples of any features appropriate to the scale of that feature. The scale of each feature or combination of features will determine the size and shape of the site boundary required for its adequate protection.

What constitutes "best", as in the "best example" of a geological feature? By virtue of its location, history, etc., each outcrop and landform may be considered unique. Depending on the level of research and study of the geology of a specific region, each unit or feature may have several known exposures or occurrences, recognizing that not all occurrences may be known at the time of study. The best example of a geological element is chosen first from one that is known to occur, and second, one which adequately displays a range of typical characteristics by which the element is recognized. Such a best example is often chosen by the consensus of geoscientists, as reflected by its use in the literature, in field trip guidebooks and by the academic community, to characterize a certain rock type, fossil assemblage, landscape or process. Additional best examples will be determined through literature review, consultation with experts in the various fields of geology, and original field work by OMNR earth science staff or consultants through theme studies or regional inventories. In the identification of elements related to the landform and process themes, an important component of this field work is the review of all available remote sensing information (particularly airphotos and surficial geology mapping).

The selection of the best representative examples of earth science features generally consist of those which have not been altered or impacted by man's activities. It is preferred that the morphological integrity of landform features, and the continuance of active geologic processes, be captured intact. However, for earth science gap analysis, the objective of selecting the best representative sites sometimes requires that parts of the landscape that have been subject to human disturbance be identified. The objective of identifying the best remaining examples of each feature relevant to the geologic history and features of the province means that, where no other examples occur or are available, then sites with acceptable degrees of impact are chosen.

While undisturbed or least disturbed sites are generally preferred in initial evaluations, a significant exception to this rule is in the selection of bedrock sites and sites consisting of unconsolidated sediments. Many of these are significant precisely because they have been artificially exposed through blasting or quarrying to reveal the internal structure of the selected geologic units or features. Road cuts, quarry faces, mine shafts, aggregate pits, etc., have existing or potential significance in defining Ontario's past environments. With every new section that is exposed, there is potential for improvement in our knowledge of an event or aspect of our geological past.

The minimum requirement of a system of protected earth science features is to represent a complete suite of elements that define each of the 43 environmental themes in Ontario. This "one-of-each" approach represents the minimum "line" required to achieve complete representation. This approach is not ideal in that it fails to provide for unforeseen events which may negatively impact this minimum. It also fails to provide the flexibility needed to address changes in ideas and concepts, and associated significant sites, with time and always expanding knowledge. Geology is a fluid science. Theories and hypotheses change as the knowledge base grows, and the list of significant sites which help to identify these new ideas may change or grow as a result.

3.3 The Gap Analysis Process

The methodology for determining the best candidate areas to represent earth science diversity within the context of an environmental theme is a comparative evaluation which has recently come to be known as "gap analysis". Gap analysis involves the description of earth science diversity in a selected theme, the identification of protection targets, the determination of which targets are already represented in a system of protected areas, and, the resultant "gaps" in representation of the diversity that still require protection. This process of comparative analysis as applied to earth science conservation has been followed in Ontario relatively unchanged since the early 1970s (Davidson 1981, Davidson 1988).

The gap analysis process is normally carried out in two phases: a broad analysis of the possible representational targets of a theme (steps 1-4), and a subsequent detailed inventory of specific features and sites required to complete representation (step 5). These steps are summarized below and in the accompanying flow chart , and described in more detail as follows:

Step 1: Identification of significant elements of a theme (representation targets);
Step 2: Distribution mapping of the significant elements;
Step 3: Determination of existing representation within protected areas;
Step 4: Identification of features not in protected areas (the "gaps");
Step 5: Identification and comparison of selected sites capable of filling the gaps.

Step 1: Identification of significant elements of a theme (representation targets)

For the selected environmental theme, this step identifies the significant elements that make up the theme; that is, the features of the theme which characterize it. This step involves the documentation of the complexity of the theme and the variations that exist in individual features of the theme. The suite of elements so identified constitutes the representation targets of the theme.

For themes identified by the bedrock record, the targets will constitute representation of each bedrock unit within the theme and its significant variations, as well as representation of unit contacts and other important associations. A chronostratigraphy, lithostratigraphy and/or biostratigraphy are assembled from this information for each theme. For themes identified in the landscape record, representation targets will consist generally of examples of landforms and landform associations that describe the environmental conditions during the selected theme. A morphostratigraphy will be prepared for each of these themes. Representational targets for landform process themes will constitute a record of the salient elements that characterize the process, be they ancient or modern. A listing of these elements is prepared for each selected theme.

This step is primarily one of information-gathering. All pertinent literature is reviewed, and discussions are sought with experts in the particular discipline or subdisciplines of geology which make up the theme (e.g., Precambrian Grenville Province bedrock; Quaternary glacial themes; Paleozoic fossil assemblages). The expertise and knowledge of the earth science surveyor/ specialist conducting the gap analysis may also contribute to site identification. In this way, features which are important to the recognition of each theme are identified.

Step 2: Distribution mapping of the significant elements

The second step requires the mapping of all significant elements of the selected theme identified in Step 1. Thus, the distribution and/or general location of all features are documented and plotted. Where complete geological mapping is available, the features of a theme may be identified on the maps. The information gathering process in Step 1 will have identified the significant elements of each theme, and will likely have identified several localities for each element. All potential site locations are plotted and mapped so that their values can be evaluated and compared during the field stage of gap analysis.

The scale and complexity of features that make up each theme is dependent on the state of knowledge of its component geology, and the spatial distribution of the theme elements on the landscape. Some environmental themes consist of only a few known occurrences of features, whereas others encompass a large portion of the province and constitute many features. Similarly, some aspects of the province's geology are well documented, whereas others are little known. These discrepancies in scale and knowledge will affect the number and size of representation targets for each theme.

Step 3: Determination of existing representation within protected areas

The next step in the gap analysis method is the identification of the elements of the theme that already occur in protected areas. At the time of writing, protected areas constitute Provincial Parks, Conservation Reserves, and Areas of Natural and Scientific Interest (ANSIs).

For a theme element or feature to be considered represented, it must be provincially significant, and it must be contained by appropriate protected area class or zoning, or have relative protection outside parks through municipal zoning or landowner agreements.

This step is again an information gathering exercise which involves a review of the available literature, notably earth science inventories of individual parks, and earth science theme studies, regional earth science systems plans and earth science checksheets prepared by OMNR since the early 1970s. The Earth Science Data Base housed with Ontario Parks, Peterborough, contains information on all Provincial Parks and earth science ANSIs in an electronic form.

Field work of a reconnaissance nature may also be required at this stage to confirm the quality and condition of identified features, especially in protected areas for which a detailed report has not been prepared.

Step 4: Identification of features not in protected areas (the "gaps")

The previous step serves to identify the elements or features of a selected theme which are formally protected in Ontario's protected areas system. The remaining elements of the selected environmental theme that are not formally protected constitute the "gaps" in representation that require filling. Sites where these elements are found are determined from the lists prepared during Steps 1 and 2. In some cases, specific localities will have been identified. These need to be field checked for quality and condition. In many cases however, specific sites will not have been identified. The geological mapping or literature searches will have identified general localities where certain features may be found. These areas will form the basis for field work to identify more specifically the location of significant features.

Step 5: Identification and comparison of selected sites capable of filling the gaps

As noted in Step 4, some unrepresented features will have been recognized through … Where more than one site is identified as representing a feature, or if a regional or area study is needed to identify new features, a comparison of like elements from the list produced in Step 4 will be required. The comparison of sites and selection of candidate areas for protection is achieved with the application of a set of six primary selection criteria. These criteria are: representation, type sections and related features (including reference sections, type morphologies, type localities), diversity, integrity (condition), life science values and special features. These are described in more detail in the following section of the report.

Step 5 involves original field work by OMNR staff or consultants to locate and evaluate the candidate sites identified in Step 4. Field work is essential in order that the most up-to-date site conditions (quality, integrity, condition), and aspects of the feature(s) not evident in the literature and/or remote sensing reviews, are recorded. A gross filtering occurs at this stage to remove sites that have a history of disturbance, past or present (primarily applied to glacial, landform and process themes). Disturbance consists of any man-made activity which has altered or removed a feature from its natural state. This criterion does not generally apply to bedrock features, which are commonly best displayed in highly altered sites such as road cuts and quarries, or to some exposures of unconsolidated sediment, which may occur in active or abandoned aggregate pits. The resulting list of the best remaining sites constitutes the set of preferred candidate protected areas for the environmental theme under study. Given that they represent the diversity of the theme in question, the sites so identified are ranked as *provincially significant* within the context of the theme.

In a large province like Ontario, there is also a need to provide for the protection of sites of regional and local significance for the benefit of scientific study and educational opportunities. Such sites also serve as back-ups for the provincially significant sites. As such, in addition to the provincially significant sites, a suite of regionally significant sites should be identified and protected. It is not the intent of the gap analysis process to bring forward regionally significant sites for formal protection. Regionally significant sites should be dealt with through other protection mechanisms (such as ANSIs, Areas of Concern, etc.) to ensure their future availability for research, educational and interpretive purposes.

3.4 Selection Criteria

The following site selection criteria are used in the identification and ranking of earth science features. Due to the nature of very different types of earth science features, the application of the criteria vary on a feature, and occasionally per-site, basis. Different approaches are applied to the representation and protection of bedrock sites, landforms, and landform-process themes (where these are modern processes active on the earth's surface today). The differences in approach are discussed in the following section.

1) Representation

The primary criterion for choosing earth science features is representation. A representative feature is one that best displays its components, or make-up, and its environment(s) of formation. A representative feature of the geological record can generally be thought of as one that is typical, or normal, or one that shows "classical" elements of the feature.

In the context of features exposed in bedrock outcrop, representation refers to the best available (or known) examples of each type of lithological unit (rock type) that occurs for a given theme element, as well as examples of each geological time unit as exhibited in the rock record (lithostratigraphy) for that theme element. In order to achieve this chronostratigraphic (time related) representation, the best example of some units may be less-than-ideal because the only known examples may be small, of poor quality, or have been adversely disturbed. In these cases, representation may still be sought in order to satisfy representation of the geologic time unit in the physical record. The best representative examples of the fossil record (in Ontario, Precambrian microfossils and Paleozoic macrofossils) as displayed in the rock record, and the best representative examples of past (ancient) landform-process themes as displayed in the rock record, are also sought for protection. Many of these will overlap with lithological and chronostratigraphic representation at the same site, imparting extra significance to those sites, and reducing the total number of sites identified.

In the landscape perspective, representation is also applied to both the physical form of a selected feature, and the morphostratigraphy (ordering of landform features through time) of a theme. Representation of the physical form of a feature should best display an "ideal" morphology and/or the best example(s) of deviations from the "ideal" form. Morphostratigraphy refers to representation of like features as they relate to events and time through the geologic record (e.g., an ice retreat phase of a glacial theme will produce similar landforms and related features at several stages in its history; elements of all of these may be targets for representation). Representation of the internal components of landforms and landform process themes will be sought in outcrops of unconsolidated sediment. Identification of these will follow the same process as for bedrock outcrops, discussed in the previous paragraph.

Representation also refers to the range of features that identifies a geologic event or process, both active today and in the rock and landform record through time. It seeks to identify the best example of each element of the 8 landform/ process themes that are considered essential to their definition. A combination of all types of geological features, from bedrock outcrops to large-scale landform associations, will be required for complete representation.

2) *Type Sections and related features*

Type sections provide standard definitions for all representative lithostratigraphic and biostratigraphic rock units. Type sections represent the sites where rock units were first identified, described and formally named. They are the localities against which all other occurrences of the unit are generally compared. Type sections are generally of the highest scientific value, and may also have historical value as locations where the geology of a region was first described and ranked. In Ontario, type sections are generally only applied to stratified rocks. These constitute volcanic and sedimentary rock sequences of Late Precambrian (Keweenawan) age and sedimentary sequences of Paleozoic age (concentrated in southern Ontario and the Hudson Bay/ James Bay Lowland), although some older Precambrian units have also been formalized in this way.

Related features such as reference sections and type localities represent units for which a type section has yet to be defined. This situation is common in central Ontario, where type sections have not been formalized for most of the Paleozoic stratigraphy of Manitoulin Island (most correlative units have type sections described on the Ontario mainland), or for the sedimentary units of the Precambrian Huronian Supergroup. Reference sections may also serve to supplement the type section by representing some variation or additional feature(s) of the original site. Reference sections often represent a regionally accessible site or variation of the original type section, an important factor where the unit has a widespread distribution.

The primary elements of the surficial geology of a region are defined by the distribution and association of related landforms and their stratigraphic makeup (morphostratigraphy), and by the type of individual landforms, the best example of each being referred to as a type morphology (or morphotype). In Ontario, the morphostratigraphy of glacial deposits and landforms, and the type morphologies related to these, have not been used in either a formal or consistent manner. Regional morphostratigraphies have been prepared by OMNR staff since 1972 in order to address this lack of formal structuring of the glacial geology of the province, and have been used to identify protection targets. The assignation of formal type morphologies within this morphostratigraphy has not been attempted to date.

3) *Diversity*

Diversity addresses the variability of form or features within a candidate site that describes a theme element. A site that incorporates more than one element or feature of the identified geologic unit (i.e., an outcrop of a bedrock formation that exhibits its range of lithologies and its contact relations with adjacent units), or, incorporates an association of features (such as a glacial landscape of drumlins, eskers and meltwater channels), usually occurs in an area more compact than several separate areas. Such associations, offering a diversity of features in a single site, are more efficient, have a higher ecological value, and may generally be ranked more favourably than a collection of individual sites in separated areas.

Very large landform features also require this approach when possible. Their size generally prohibits representation of a complete feature or association of features. This applies to features with extensive linear elements and those with broad areal extent. Examples of linear geological features include bedrock faults and shear zones, glacial features such as meltwater channels, end moraines, eskers and raised shorelines, and geomorphological elements such as bedrock escarpments and riverine environments. Features with a broad areal extent include bedrock domes, glacial features such as ancient lake plains, dune fields, and outwash plains, and topographic forms such as ancient meteorite impact craters.

The approach taken to representation of these large landform features focuses on the identification of the major elements which make up the feature, and seeking representation of the best examples of each of these elements. For example, the Cartier Moraine belt across the north shore of Lake Huron consists of a series of mounds and ridges of ice-contact sediment, anchored to bedrock knolls, which are associated with shoreline elements of glacial Lake Algonquin, such as now-abandoned (raised) beach terraces on perched deltas. Representation of this complex of features focuses on the identification of the best examples of each of these elements: an irregular mound element of ice-contact debris; a ridge element of ice-contact debris, preferably intact (i.e., identified by topography along natural boundaries); the bedrock component integral to the story of formation of the moraine; and, a perched delta with its associated beach elements. Where several elements occur together, and their form adequately display the mode of formation of the features and their link to the ice stand position marked by the moraine, an area boundary encompassing this association of elements is desirable. Such feature associations are preferred particularly because they exhibit the inter-relationships within a diverse morphology, and because they occur together, facilitating protection more easily than would a suite of separate sites.

4) *Integrity (Condition)*

Integrity refers to the wholeness or completeness, or condition, of a geological feature, and the lack of significant external impacts or alteration by natural or man-induced activities on this wholeness. This applies particularly to landforms, where morphological completeness is a requirement for their adequate definition. Examples of landforms for which complete morphological representation is desirable are usually relatively small and discrete (e.g., drumlins, perched deltas, aeolian dunes, landslides and their ancient scars, etc.). The best examples of these may be considered informal type morphologies.

Site integrity is not as important a factor in the representation of bedrock sites. Adequate representation of a particular lithological (bedrock) unit requires a clear face or surface which exhibits all the elements used to define the unit. These may occur in a natural setting, such as on bare bedrock surfaces (the Georgian Bay Fringe area and north shore of Lake Huron are outstanding examples of this) or in cliff face exposures (the Niagara Escarpment is the best example of this). Here, site integrity may be excellent due to the extent of exposure (horizontally and/or vertically), and constitutes an aesthetic component due to the natural setting.

In most cases, however, the best examples of representative bedrock units occur in man-made exposures such as highway or road cuts, and pits and quarries, where aesthetic qualities may be very low, but representational values are high because of the freshness and quality of exposure. Such man-made exposures are often th eonly available representation of the internal components of the bedrock of a region. They may provide a three-dimensional view not available anywhere else. In such cases, natural site integrity is not a consideration for representational rank. Protection of such sites will focus on ensuring that the selected outcrop is not permanently covered up or removed. Site integrity may, in some cases, be enhanced by one-time or occasional re-exposure, or "freshening", of exposures. This is particularly true of natural riverbank exposures and in man-made aggregate operations and quarries that support outstanding exposures of unconsolidated sediments.

5) Life Science Values

When comparing sites where earth science values are similar, overlapping life science values may be used to choose a site. This approach is generally only relevant to landscape sites (landforms, landform associations and/or process features) which are large enough to support significant vegetation stands or communities. Small sites (outcrop or some landform-scale features) generally do not constitute a large enough area to contribute to protection of most life science values. Smaller geological features can however, form a component of a larger life science site, and would constitute a preferable site choice given equal values elsewhere. The evaluation of overlapping life science values depends on the level of existing life science information or the availability of life science input to site selection.

The life science classification system used in the gap analysis process has a strong landform-based component in its Site District target identification. Protection of the diversity of landform/ vegetation units (LV units) in a Site District ensures that identification of a broad range of landforms is targeted for protection. However, the landforms identified by the life science process may not (and often do not) represent the best examples of those landforms to contribute to representation of earth science targets. Where possible, comparison with selected life science candidate protected areas is always attempted before final determination of candidate earth science areas.

6) Special Features

Where two or more sites have similar earth science values, the presence of special features may determine the selection of a preferred site. Special features may be geological, such as unusual or unique elements of a theme not represented elsewhere, or regionally important sites used for education and/or interpretation. Special features may also constitute less scientific values such as the quality of a feature's setting or the aesthetic values of a site. The geology of an area may contribute significantly to the character of that area's landscape.

Where known occurrences of a particular unit are already included in the system of protected areas, the selection of discrete bedrock and unconsolidated sediment sites (e.g., road-side outcrops, quarries, aggregate pits, etc.) popular with the geoscience community (i.e., documented in field trip guidebooks), *in addition to the sites identified in protected areas*, may be of importance because they are accessible, known to geologists, and serve to protect significant occurrences for further research and educational values. This duplication has many values, the most notable of which is that units may be observed, studied, and interpreted at some distance from the provincially significant occurrences, thereby allowing interested parties in regional settings access to good sites. Another important value of regional site duplication is in their role as backups or alternatives to the primary sites, should the primary sites be adversely disturbed or lost.

Geology, and particularly geomorphology, often determines the impact of the landscape it creates on the culture that inhabits it. A particular landscape or landform association may be integral to that culture, be it local, regional or national. Any dramatic change in its integrity might have detrimental effects on the overall culture. Where the scientific values are equal, the choice between two or more sites may thus be determined by the cultural or aesthetic values of a particular natural setting. For example, the geology influences the setting and landscape of many areas of Ontario, and influence how these areas are perceived by the population, both residents and non-residents of those areas, beyond the required representation of individual units. Outstanding examples include, but are not restricted to, the low rocklands and lakes of Muskoka, the white quartzite hills and ridges of the LaCloche Range near Killarney, the mesa and cuesta topography of the Nor'Westers around Thunder Bay and Lake Nipigon, the quartzite canyons in the Raven Lake area near Elliott Lake, and the incised valleys of the Pinad Moraine in northeastern Ontario. Representation of such "landscapes" is integral to the earth science protection strategies of many countries world-wide. The maintenance of these landscape values in Ontario may also be considered in earth science gap analysis where appropriate.

3.5 Comparisons with Life Science Representation

There continues to be confusion about the relationship and differentiation between earth science representation targets and life science representation targets. How does earth science representation compare to life science representation?

Earth science classification systems, based on physical features and, importantly, on time, cannot generally be correlated with the life science classification system, which is based on macroclimate, landforms, microclimate, moisture regime, and substrate (Angus Hills' division of the province into Site Regions and Site Districts, with classification of site conditions within each Site District; see Hills 1959, Burger 1993, Jalava *et al.* 1997). Although there may be some correlation between the two disciplines based on landform and substrate, earth science classification is not related at all to present patterns of climate and moisture.

For example, Precambrian Grenville Province rock types and environments occur geologically to a specific area of exposure, in south-central Ontario. The diversity of features which reflect the history of evolution of the Grenville Province can only be found within this specific area of exposure. The geological diversity within the area of exposure of the Grenville Province, and its significance, is not affected by the vegetation patterns which occur on its surface, nor by the classification schemes devised to arrange that vegetation diversity. Therefore, the distribution of significant earth science sites required to represent the Grenville Province geological theme cannot be related to a Site District and is therefore not affected by life science values. However, the type and aspect of the bedrock substrate may have a significant influence on the composition of the vegetation communities and species that grow on that substrate. Obvious examples are the different effects of carbonate versus granitic substrates on the vegetation communities growing on them.

Although earth science and life science classification schemes are not compatible, there is an inter-connectedness between the two disciplines at the landform/substrate level. The diversity of earth science features at the Site District level will determine the diversity of life science representation targets for vegetation communities and species. Earth science diversity in a Site District presents the biological environment with a range of temperature, exposure, aspect, moisture regime, substrate types and habitat on which vegetation types and communities develop and evolve. The land base of an area determines the diversity of the life forms that occupy and characterize that area.

As stated in the previous section, where all other factors are equal, it is a goal of OMNR's gap analysis process, where possible, to combine earth science and life science values into a set of related protected areas. Thus a suite of sites so selected will help to conserve both regional biodiversity and abiotic features.

A comparison of the gap analysis process and the site selection criteria for earth science representation and life science representation shows that these are very similar in approach. The cornerstones of both approaches are the achievement of a suite of sites that are representative, in excellent condition, and reflect the diversity of the features and history identified by the individual disciplines.

3.5 Assumptions

The data sets used in the earth science gap analysis process come in many forms and scales. None exists satisfactorily in any one place or as one unified entity. Primary sources include maps of bedrock and surficial geology, published in a wide variety of scale, detail and coverage, by the Ontario Geological Survey (OGS; Ontario Ministry of Northern Development and Mines) and the Geological Survey of Canada (GSC). Interpretations of the geological history of the province are extracted from a vast base of academic and professional literature sources, as well as discussions with experts in all fields of geology. Interpretations often differ due to the fluid nature of the science, as data becomes available and is disseminated to the field. Given this range of inputs, it is assumed that the present level of knowledge of the geological conditions in the province is the most up-to-date and complete, despite obvious weaknesses in that knowledge. The Geology of Ontario (Ontario Geological Survey 1991, 1992) summarizes the most up-to-date geological picture of the province, and provides the framework on which the interpretations used in gap analysis are based. Detailed information about the geology of much of the province is limited. Because the search for knowledge has been largely driven by past and present interest in the economic potential of an area's mineral or aggregate resources, there remain large areas of the province in which detailed data collection and interpretation has not been attempted or completed.

The geological definition and interpretations of significant sites only reflect the current state of knowledge and/or follow current understanding and theories of concepts in the particular field of geology under consideration. Theories and ideas, and their associated evidence in the field (on the ground) that may be important today, may become less important or redundant in future with the advent of new field work or other studies. Advancement of new theories and concepts will involve new sites of importance in providing proof. Thus where previously important sites become less so, new sites may be introduced to define the new science. What is important in the gap analysis planning process is the opportunity to identify and protect a near-complete system of representative and significant features reflecting the present state of the science, and the flexibility to incorporate changes and advances in the science.

In the case of landforms and landform process themes, an underlying assumption is that the least disturbed a site or feature is, the better its representational value. Where undisturbed features are not available, a site with some disturbance may be preferable to no representation at all. Other jurisdictions world-wide, including ANSIs in Ontario, assume some disturbance is acceptable if that disturbance has not adversely altered the conditions of the feature(s) for which identification was first proposed.

Field investigation of the attributes of the feature(s) of a site is almost always required prior to the determination of significance. For instance, bedrock sites are small enough that no matter how well documented, exact locations and present condition need to be established *in situ* in order to properly verify and protect a site. Although remote sensing techniques can determine the best likely locations for landform and process theme sites, present-day quality and condition of the identified features must be verified and established in the field prior to the determination of representation and/or significance.

3.6 Limitations

As already mentioned, geological mapping coverage and scales vary greatly across the province. Therefore, a lot is known about the geology of selected regions and/or geological environments, and hence selected environmental themes, and less is known about others. The effect this has on representation targets is that the environmental themes with a good base of knowledge may have a great number of representational targets, whereas those environmental themes about which relatively little is known will have fewer representational targets. As the knowledge base in these under-represented themes improves, with new, more detailed mapping of a region, new representational targets will present themselves, and the number of candidate sites may increase.

The data set of information related to the bedrock geology of the province is limited to sites that are known from the published literature, and those known to the geoscience and academic community. The specific attributes and values of bedrock sites are too difficult to identify through remote sensing methods (bedrock sites are generally too discrete), with the result that the geology of an area cannot easily be interpreted and compered with such regional techniques. Landforms and some process themes on the other hand can generally be identified quite easily through remote sensing techniques (through geological and topographical maps, airphotos, etc.). This limits the bedrock site representation to what we know, whereas landform and some process themes can be identified through original field work on a very regional level (i.e., it can therefore be done relatively quickly).

Another limitation of the gap analysis process is that much geological data, especially more detailed information, is not readily available in digital format, although coverage is improving rapidly. This limits the ready comparison of site evaluations on a regional scale through electronic means, and still requires a high degree of manual inputs.

4.0 ACKNOWLEGEMENTS

The life science gap analysis method has evolved from manual approaches used since before 1980, to the electronic iterative process described in this document. Many people have been involved in these processes and its evolution. Specific to the present document, several people have provided comments on earlier drafts of this paper. In particular, Jarmo Jalava, Stewardship Biologist, Natural Heritage Information Centre, Peterborough, provided stimulating discussion and editorial comments at several stages in the writing of this document.

The earth science gap analysis process has been in use, relatively unchanged, since the early 1970s. The concepts and procedures presented in this document reflect the input and refinement of this process by many field staff during that time. Specific to this document, R.J. (Bob) Davidson, Senior Conservation Geologist, and G.S. (George) Cordiner, Conservation Geologist, both of MNR Ontario Parks, Peterborough, provided timely discussion and review.

5.0 LITERATURE CITED

Beechey, T. J. 1980. A Framework for the Conservation of Ontario's Biological Heritage. Ontario Ministry of Natural Resources, Parks and Recreational Areas Branch, Toronto, Ontario.

Beechey, T. J. and R. J. Davidson. 1980. Protection of Provincially Significant Wildlife Areas: the Nature Reserve System; *in* Protection of Natural Areas in Ontario, Proceedings, University of Toronto, Faculty of Environmental Studies, Working Paper No.3.

Burger, D. 1993. Revised Site Regions of Ontario: Concepts, Methodology and Utility. Ontario Forest Research Institute Forest Research Report No. 129.

Chapman, L. J. and D. F. Putnam. 1984. The Physiography of Southern Ontario. Third Edition. Ontario Geological Survey Special Volume 2.

Davidson, R. J. 1981. A Framework for the Conservation of Ontario's Earth Science Features. Ontario Ministry of Natural Resources, Parks and Recreational Areas Branch, Open File Earth Science Report 8101.

Davidson, R. J. 1988. A strategy for the conservation of Ontario's Earth Science Heritage. Ontario Ministry of Natural Resources, Provincial Parks and Natural Heritage Policy Branch, Earth Science Open File Report 8801.

Harris, L. D. 1984. The Fragmented Forest. University of Chicago Press, Chicago, Illinois.

Hills, G. A. 1959. A Ready Reference to the Description of the Land of Ontario and its Productivity. Ontario Department of Lands and Forests, Division of Research, Maple, Ontario.

Jalava, J. V., J. L. Riley, D. G. Cuddy, and W. J. Crins. 1997. Natural Heritage Resources of Ontario: Revised Site Districts in Ecological Site Regions 6E and 7E. [draft]. Ontario Ministry of Natural Resources, Natural Heritage Information Centre, Peterborough.

Noble, T. W. 1982. Life Science Report, Site Region 4E (Within Northern Region) (Abridged). Ontario Ministry of Natural Resources, Northern Region, Cochrane.

Noble, T. W. 1983. Biophysiographic Analysis, Site Region 5E, Algonquin Region. Ontario Ministry of Natural Resources, Algonquin Region, Huntsville.

Ontario Geological Survey. 1991. Geology of Ontario; Ontario Geological Survey, Special Volume 4, Part 1.

Ontario Geological Survey. 1992. Geology of Ontario; Ontario Geological Survey, Special Volume 4, Part 2.

Ontario Ministry of Natural Resources. 1997. Nature's Best: Ontario's Parks & Protected Areas: A Framework & Action Plan; Ontario Ministry of Natural Resources, Lands and Natural Heritage Branch, Natural Heritage Section, Peterborough.

Appendix I:

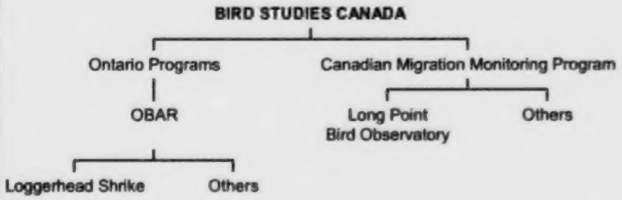
List of broad age classes for working groups likely to be encountered in FRI data.

White Pine	Pw	0-40 (1959-)	41-120 (1879-1958)	121+ (pre-1879)
Red Pine	Pr	as Pw		
Tamarack	L	as Pw		
Black Ash or Ash	Ab or A	as Pw		
Sugar Maple	Mh	as Pw		
Yellow Birch	By	as Pw		
Red Oak	Or	as Pw		
Red/Silver Maple	Ms	as Pw		
Beech	Be	as Pw		
Basswood	Bd	as Pw		
Other hardwoods	OH or H	as Pw		
Jack Pine	Pj	0-30 (1969-)	31-70 (1929-1968)	71+ (pre-1929)
Balsam Fir	B or Bf	as Pj		
Poplar/aspen	Po	as Pj		
White Birch	Bw	as Pj		
Spruces	S, Sb, Sw	0-30 (1969-)	31-100 (1899-1968)	101+ (pre-1899)
Cedar	Ce	0-40 (1959-)	41-110 (1899-1958)	111+ (pre-1889)
Hemlock	He	0-40 (1959-)	41-140 (1859-1958)	141+ (pre-1859)

APPENDIX F

Agencies and Organizations, Their Major Activities and Information Available[1]

This appendix provides a list of key agencies and/or organizations and information that may be useful for the identification of significant wildlife habitat. The websites and phone numbers were current as of October 1999, and however, are subject to change.

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Agriculture and Agri-Food Canada http://www.agr.ca/	*Best Management Practices* series of publications : e.g. *Fish and Wildlife Habitat Management, Water Management, A First Look - Practical Solutions for Soil and Water Problems* • also offers a wide range of identification services (e.g. plants, invertebrates) • has a butterfly expert on staff
Bird Studies Canada – Ontario http://www.bsc-eoc.org/ontario.html also see information on **Long Point Bird Observatory**  BIRD STUDIES CANADA Ontario Programs Canadian Migration Monitoring Program OBAR Long Point Bird Observatory Others Loggerhead Shrike Others	Administers a variety of bird monitoring programs. • Ontario Birds at Risk (OBAR) a program started in 1994 to build upon work which began with the *Atlas of the Breeding Birds of Ontario* (1981-1985) and the *Ontario Rare Breeding Bird Program* (1989-1993). The goal of OBAR is to work towards the protection and recovery of vulnerable, threatened and endangered (VTE) and other bird species at risk in Ontario. Target list is derived from COSEWIC, COSSARO lists and recommendations from the OBAR Advisory Committee. • seasonal summaries of bird sightings • Ontario heronry inventory • woodlands fragmentation studies • nocturnal owls survey • survey information about loggerhead shrike, red-shoulder hawks, woodpeckers, barn owls and prothonotary warbler • Great Lakes marsh monitoring program (includes amphibian, marsh bird monitoring)
Canadian Museum of Nature http://www.nature.ca/ P.O. Box 3443, Station D Ottawa, Ontario K1P 6P4	• the library of the Canadian Museum of Nature contains over 42,000 books and 100,000 volumes of periodicals on a wide variety of topics in the fields of biology, biodiversity, botany, ecology, mineral sciences, natural history, paleobiology and wildlife • provides taxonomic identification services • publications (for sale) such as checklists of mosses, vascular plants, lichens of Ontario

---

[1] The web site addresses in this list were last checked for accuracy on September 21, 2000.

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Canadian Wildlife Federation http://www.cwf-fcf.org/ 2740 Queensview Drive Ottawa, Ontario K2B 1A2 Phone: (613) 721-2286 or 1-800-563-WILD	• directory of CWS wildlife surveys • Remedial Action Plans
Canadian Wildlife Service Environment Canada 351 St. Joseph Boulevard Hull, Quebec K1A 0H3 Tel.: (819) 997-1095 Fax: (819) 997-2756 http://www.cws-scf.ec.gc.ca/cwshom_e.html also see **Environment Canada** http://www.ec.gc.ca/ http://www.cws-scf.ec.gc.ca/sara/main.htm Http://www.cws-scf.ec.gc.ca/hww-fap/eng_ind.html	handles wildlife matters that are the responsibility of the federal government • includes protection and management of Migratory Birds (*Migratory Birds Convention Act*), nationally significant habitat and endangered species (Canada *Endangered Species Protection Act*), other wildlife issues of national and international importance; conducts research in many fields of wildlife biology; also conducts research on the socio-economic importance of wildlife • endangered species fact sheets • Wild Animal and Plant Protection and Regulation of International and Inter-provincial Trade Legislation • information on Canada's law to control trade in wild animals and plants • current Migratory Birds Hunting Regulations • environmental assessment guidelines (*Canadian Environmental Assessment Act*) • publications e.g. – Hinterlands Who's Who series; endangered species fact sheets • information on Ramsar Sites and Biosphere Reserves
Conservation Authorities for addresses, phone numbers and web site locations of local offices see: http://www.geocities.com/Yosemite/Trails/1551/conserv.htm or write : Conservation Ontario Box 11, 120 Bayview Parkway Newmarket, ON L3Y 4W3 (905) 895-0716 E-mail - conserve@idirect.com	• watershed plans • floodplain mapping and fill regulations • some inventory or other pertinent information about Conservation Authority-owned lands • natural heritage inventories • information on woodlands, wildlife habitat, wildlife movement corridors, fish habitat, environmentally sensitive areas, wetlands, valleylands, shorelines • GIS formatted natural heritage databases • watershed plans and inventories • floodplain and hazard land mapping

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
(The) **Conservation Council of Ontario** 43 Sorauren Ave Toronto, Ontario M6R 2C8 phone: (416) 410-6637 http://greenontario.com/cco.htm http://www.greenontario.com/	The Conservation Council of Ontario (CCO) is an association of twenty-five provincial organizations and fifty individual members who work to promote effective action on environmental issues. Our member organizations include environmental, naturalist, and professional associations and our Individual Members reflect a broad range of interests and expertise. • a directory of governments, organizations and major businesses in Ontario
COSEWIC – Committee on the Status of Endangered Wildlife to order copies of status reports write to: Mrs. Sylvia Normand COSEWIC Secretariat c/o Canadian Wildlife Service Environment Canada Ottawa, Ontario K1A 0H3 Tel: (819) 997-4991, (819) 994-2407 Fax: (819) 994-3684 Http://www.cosewic.gc.ca/COSEWIC/Default.cfm http://www.mcgill.ca/Redpath/cosehome.htm http://magi.com/~ehaber/ http://infoweb.magi.com/~ehaber/b_intro.html	COSEWIC determines the national status of wild Canadian species, subspecies and separate populations suspected of being at risk. Decisions are based on the best up-to-date scientific information available. All native mammals, birds, reptiles, amphibians fish, molluscs, butterflies and moths, vascular plants, mosses and lichens are included in its current mandate. • updated lists of extirpated, endangered, threatened and vulnerable species • guidelines for the preparation of status reports • subcommittee for reptiles and amphibians • subcommittee for vascular plants, mosses and lichens • subcommittee for birds
COSSARO **- Committee on the Status of Species at Risk in Ontario** co-ordinated by Ontario Ministry of Natural Resources	• assigns status and maintains updated lists of extirpated, endangered, threatened and vulnerable species for Ontario • recovery planning and plan implementation
Ducks Unlimited Canada (Ontario) local offices located in Barrie, Timmins, Kingston, Thunder Bay http://vm.ducks.ca/prov/DUCONT.HTM Ducks Unlimited (Canada) The Oak Hammock Marsh Conservation Centre Box 1160 Stonewall, Manitoba R0C 2Z0 Phone (204)467-3000 OR 1-800-665-DUCK.	• advice on wetland management administers *Ontario LandCare* - financial incentives and technical assistance help farmers conserve their soil and water resources while improving the environment for wildlife and for people • biological and behavioural information about waterfowl • brood surveys

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Eastern Ontario Model Forest http://www.eomf.on.ca/ Postal Bag 2111 Kemptville, Ontario K0G 1J0 Tel: 613.258.8241	• mapping and information services for landowners, governing bodies and organizations • thematic maps, aerial photographs, spatial analysis, topographic maps any size or scale in eastern Ontario • publications
Federation of Ontario Naturalists 355 Lesmill Road http://www.ontarionature.org/ Don Mills,Ontario M3B 2W8 Phone: (416) 444-8419	• a membership-based non-profit, non-government organization dedicated to protecting and conserving Ontario's natural heritage. • conducts scientific research, initiates nature protection programs and contributes to public policy relating to land use issues • information on invasive species, backyard habitats, Great Lakes Wetlands publications • educational resources
Field Botanists of Ontario Bill McIlveen (membership) RR 1, Acton, Ontario N1H 4A6 Ed Morris (newsletter) RR 3, Sudbury, Ontario P3E 4N1	• field trips, workshops intended to provide members and non-members with opportunities to learn Ontario's flora and natural areas • newsletter
Landowner Resource Centre http://www.lrconline.com/ P.O. Box 599 5524 Dickinson Street Manotick, Ontario K4M 1A5 Phone: (613) 692-2390	• information on forestry, agriculture, wildlife, water, soil and any land management issues • environmental facts sheets, publications • workshops
Long Point Bird Observatory http://www.bsc-eoc.org/Lpbo.html	A research and monitoring station operated by Bird Studies Canada • research directed at the conservation of wild birds and their habitats. Programs at Long Point are focused on local breeding and migratory birds. • publishes results of studies of wild birds and their habitats
Natural Heritage Information Centre (NHIC) Ministry of Natural Resources 300 Water Street, 2nd Floor, North Tower Peterborough, Ontario K9J 8M5 Phone: (705) 755-2159 Fax: (705) 755-2168 http://www.mnr.gov.on.ca/MNR/nhic/nhic.html	Compiles, maintains and provides information on rare, threatened and endangered species and spaces in Ontario. This information is stored in a central repository containing a computerized database, map files and an information library, which are accessible for conservation applications, land use planning, park management, etc. • lists of Ontario species • vegetation communities and ecological land classification

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Natural Resources Canada **Canadian Centre for Remote Sensing** http://www.ccrs.nrcan.gc.ca	• responsible for the acquisition of earth observation data and for the development of remote sensing applications and related methodologies and systems
Canada Land Inventory (CLI) http://geogratis.cgdi.gc.ca/CLI/frames.html	• CLI is a comprehensive, multi-disciplinary land inventory of rural Canada, covering over 2.5 million square kilometres of land and water. Land capability for agriculture, forestry, recreation and wildlife (ungulates and waterfowl) is mapped. Over 1000 map sheets at the 1:250,000 scale are available on this site for on-line map making and download of desktop publishing, or GIS formats
Ontario Environmental Network http://www.web.net/~oen/ 27 Douglas Street Guelph, Ontario N1H 2S7 (519) 837-2565	• provides a central referral service for anyone seeking environmental information, organizes workshops and conferences, publishes resource materials and facilitates issue specific caucuses. • also maintains a database of Ontario environmental groups and a delegate database for public consultations • web site provides background information about the Environmental Bill of Rights (EBR) and the electronic Environmental Registry
Ontario Federation of Anglers and Hunters http://ofah.org/ P.O. Box 2800 Peterborough, Ontario, K9J 8L5 Phone: (705) 748-6324	• invading species resource library • Invading Species Hotline at 1-800-563-7711 • conservation news updates
Ontario Field Ornithologists http://www.interlog.com/~ofo/ Box 455, Station R Toronto, Ontario M4G 4E1	• an organization dedicated to the study of bird life in Ontario • current field checklist of Ontario birds "Ontario Birds" includes notes and articles concerning the status, distribution, identification and behaviour of Ontario's birds, as well as site guides, book reviews, letters and the Annual Report of the Ontario Bird Records Committee (OBRC)
Ontario Fur Managers Federation 531 Second Line East Sault Ste. Marie, Ontario P6B 4K2 Phone: (705) 254-3338 Fax: (705) 254-3297	• promotes conservation, sustainability of fur bearers and ecosystem • promotes, participates in public education and awareness • fur bearer information

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Ontario Ministry of Agriculture and Rural Affairs http://www.gov.on.ca/OMAFRA/english/ http://www.gov.on.ca/OMAFRA/english/products/soils.html	• products and services catalogue • soil survey reports and agricultural capability maps
Ontario Ministry of Natural Resources (also see NHIC) http://www.mnr.gov.on.ca/MNR/index.html Main Office – Peterborough 300 Water Street P.O. Box 7000 Peterborough, Ontario K9J 8M5 Natural Resources Information Centre Toronto: General Inquiry (416) 314-2000 French Inquiry (416) 314-1665 Peterborough: General Inquiry (705) 755-2000	• land use planning and land information • fish and wildlife information • forest information, Forest Resource Inventory (FRI) maps , Forest Management Plans for Crown Lands • maintains provincially and non-provincially significant wetland evaluations • Areas of Natural and Scientific Interest Site District reports • Ontario's parks information • e.g. *Fish and Wildlife Conservation Act* and other related legislation • extinct, extirpated, vulnerable, threatened and endangered species lists for Ontario • regional checklists of Ontario's species at risk • wildlife management guidelines • aerial photographs (1:10,000 and some 1:15,840) • Growth and Yield and Ecological Land Classification information • maintains Natural Values Information System
Ontario Ministry of Northern Development and Mines http://www.gov.on.ca/MNDM/ndmhpge.htm Willet Green Miller Centre 933 Ramsey Lake Road, Level A3 Sudbury, Ontario P3E 6B5 Phone: 1-888-415-9845 (toll-free) Phone: (705) 670-5691 (local calls) Fax: (705) 670-5770	• locations of abandoned mines that might provide potentially significant bat hibernacula • National Topographic System (NTS) of digital base maps, at a 1:250,000 scale • bedrock geology of Ontario data; mining claim maps by township/area • local claim maps are available for viewing at all Mining Lands Consultant's offices as well as at the District Geologist's offices in Kenora and Sioux Lookout • Regional Resident Geologist's and District Geologist's offices provide advice and information on local geology, mineral exploration opportunities and activities, and public access to geological data, including industry assessment files, mineral deposits information and diamond drill core • publication sales, Mines Library, access to assessment files, geoscience information, public education at the Willet Green Miller Centre in Sudbury

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
Ontario Soil and Crop Improvement Association 1 Stone Road West Guelph, Ontario N1G 4Y2 Phone: 519-826-4214 http://www.ontariosoilcrop.org/	Promotes the responsible economic management of soil, water and crops. • keeps farmers up-to-date on conservation and production issues, including information on government programs and initiatives • develops and delivers educational packages, demonstration projects, environmental improvement programs, and investigative surveys
Parks Canada http://parkscanada.pch.gc.ca/parks/main_e.htm National Office 25 Eddy Street Hull, Quebec K1A 0M5	Offers information pertaining to National Parks • ecological inventories (wildlife and plant species lists), research and studies, information on changes in species occurrence, GIS database
Recovery of Nationally Endangered Wildlife (RENEW) (see COSEWIC)	• co-ordinates preparation, distribution of recovery plans for species designated by COSEWIC as nationally threatened or endangered
Royal Ontario Museum http://www.rom.on.ca 100 Queen's Park Toronto, Ontario M5S 2C6	Canada's largest museum features galleries in Art, Archaeology, Science
http://www.rom.on.ca/ontario/index.html	• index of available information
http://www.rom.on.ca/ontario/risk.html	• regional lists and species profiles of the plant and animal species at risk in Ontario (provided by COSSARO)
http://www.rom.on.ca/ontario/fieldguides.html	• lists of common mammals, birds, reptiles, amphibians and fish in Ontario by county
Soil and Water Conservation Society http://www.swcs.org/ 7515 NE Ankeny Road Ankeny, Iowa 50021 Phone (515) 289-2331 Fax (515) 289-1227	An international organization comprised of more than 10,000 professionals and students involved in conservation. • publishes *The Journal of Soil and Water Conservation,* a scientific journal; *Conservation Voices: Listening to the Land,* a magazine with articles about relationships between rural and urban dwellers, erosion control, wetlands restoration, and community-supported watershed projects; and *Conservogram,* a newsletter.
Universities	• plant and animal collections (with locations and dates) • plant and animal reports and studies • access to researchers with expertise in a variety of fields

AGENCY/ORGANIZATION	ACTIVITY/INFORMATION
University of Guelph Arboretum http://www.uoguelph.ca/~arboretu/ University of Guelph Arboretum Guelph, Ontario N1G 2W1 Phone: (519) 824 4120 ext 2113 Fax: (519) 763 9598	• coordinator of Ontario Tree Atlas • conducts research • access to researchers
Wildlife Habitat Canada 7 Hinton Avenue N., STE 200, Ottawa, ON K1Y 4P1 Phone: (613) 722-2090 http://www.wetlandfund.com/english.htm	• publications • Wetland Habitat Fund - provides private landowners with financial assistance for projects that improve the ecological integrity of wetland habitats
World Wildlife Fund (Canada) http://www.wwfcanada.org/ 245 Eglinton Avenue East Suite 410 Toronto, Ontario (416) 489-3611 M4P 3J1 Phone: 1-800-26-PANDA (toll free) Phone: (416) 489-8800 (Toronto area) Fax: (416) 489-3611	• maintains lists for Canadian wildlife at risk by province • fact sheets on species and conservation issues • publications

APPENDIX G

Wildlife Habitat Matrices and Habitat Descriptions for Rare Vascular Plants.

This appendix contains specific habitat descriptions for plant and animal (amphibians, reptiles, birds, mammals) species that occur in Ontario and which are most likely to be affected by changes in the landscape as a result of development pressures associated with the *Planning Act*. Those species that are known to only occur in Hill's Site Regions 1E, 2E And 3E have been excluded from these lists since there is very little likelihood that these species would be affected by *Planning Act* applications. The wildlife habitat matrices are intended to provide the user with some information about the plant and animal species that are likely to occur in a particular planning area and what habitat they are most likely to be found in. In addition, the tables identify those animal species that use many of the habitat categories identified as significant. These include seasonal concentrations of wildlife, specialized habitats for wildlife, habitat for species of conservation concern and animal movement corridors.

Appendix G is comprised of five tables. They are as follows:

Table G-1. Habitat descriptions for native Ontario amphibians.
Table G-2. Habitat descriptions for native Ontario reptiles.
Table G-3. Habitat descriptions for native Ontario birds.
Table G-4. Habitat descriptions for native Ontario mammals.
Table G-5. Habitat descriptions for rare, vascular plants that are tracked by the Ministry of Natural Resources Natural Heritage Information Centre.

How to this appendix

This appendix provides a summary of plant and animal distributions in Ontario by Hill's Site Regions and Districts; site descriptions for plant species[1] and habitat/habit descriptions for animals. The plant list is arranged alphabetically by family. The animal lists are listed phylogenically (in taxonomic order).

1. Determine what species may be in your planning area

By noting the Site Region or Site District location, the reader can quickly ascertain what species may occur in their area of study.

2. Consider what habitat features and therefore what species your planning area may support

General habitat features are recorded to the far right of each table. A slight variation between the plant and animal lists occurs in this part of the matrices. Many of the habitat features are described in the text of the Technical Guide or are self-explanatory. As an example, *thickets, second growth*, found in the animal matrices includes fencerows, early succession growth of old fields and secondary growth as a result of a clear-cut operation or fire. A check mark under a column heading indicates that the corresponding species uses this habitat type during some part of its life.

---

[1] Sources: Argus et al. 1987. Atlas of Rare Vascular Plants in Ontario.

3. Determine each species general habitat requirements and habits

Column two of the matrices provides a detailed description of habitat for each species. Particular habits of a species may also be described. The information provided here is limited because of space. A proponent would be expected to provide more detail on the habitat requirements and life history parameters for key species when preparing an Impact Assessment.

The animal matrices have four additional columns on the right-hand side of the table that indicate whether a species is colonial (birds) or concentrates seasonally; is a cavity user, is area sensitive and, if the species is provincially rare.

Seasonally Concentrated/Colonial

Many species congregate at a specific time of the year in very specific habitat. These habitats are used repetitively and animals are often very vulnerable at this time. Bats, some amphibians and reptiles hibernate in groups; waterfowl and many bird species migrate in large numbers during the spring and fall; deer concentrate in wintering yards; many bird species nest in colonies. Survival of these species depends on the continued availability of these areas.

Cavity User

Many species rely on cavities in trees, crevices in rocks and slopes and holes in the ground to nest, roost or hibernate. Many species use the same cavity year after year (traditional use). The loss of traditional sites can be detrimental to many species.

Area Sensitive

Some species require large areas of suitable habitat for long term population survival. Fragmentation of essential habitats can result in overall declines in populations.

Provincial Rarity

Staff from the Ontario Ministry of Natural Resources Natural Heritage Information Centre (NHIC) use a provincial ranking system to set protection priorities for rare species and natural communities. These rankings have been included in the first column for each of the tables in this appendix. Not recorded in these lists are those species that are not believed to be a native component of Ontario's flora or fauna (ranking code SE).

A species that is ranked as an S1, S2 or S3 is considered provincially rare.

Definitions of Provincial Ranking Codes Used by NHIC

S1 Extremely rare in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.

S3 Rare to uncommon in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S4 Common and apparently secure in Ontario; usually with more than 100 occurrences in the province.

S5 Very Common and demonstrably secure in Ontario.

In some cases NHIC goes one step further for birds by including a suffix to the ranking to indicate whether species is ranked according to its **breeding (B)** or **non-breeding (N)** status in Ontario.

S#? Uncertain (e.g. S1?) in Ontario. These species are thought to be rare in Ontario, but is insufficient information available to assign a more accurate rank.

SU Unranked.

SH Historically known from Ontario, but has not been recorded in the last 20 years. It is believed that suitable habitat is thought to still be present in the province. There is some expectation that a species with this ranking may be rediscovered in the province.

SR Reported for Ontario with less than convincing documentation to either accept or reject the report.

SX the species is apparently **extirpated** from Ontario with little chance of rediscovery. These species have not been seen for many decades even though searches of historic locations have been done.

Species recorded as Vulnerable, Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the Committee of the Status of Species at Risk in Ontario (COSSARO) or Ministry of Natural Resources (MNR) are marked accordingly with a V, T or E in small, capital letters after the scientific name of the species followed in parentheses by the designating authority. A note also is included when a species is protected by provincial legislation.

Table G - 1: Habitat descriptions for native Ontario amphibians.

Family Name Scientific Name Common Name NHIC ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands/ Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Seasonally Concentrated	Cavity User	Provincially Rare	Area Sensitive
AMBYSTOMATIDAE *Ambystoma jeffersonianum* Jefferson Salamander S2	damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding; hides under leaf litter, stones or in decomposing logs	6E(1); 7E(2,5)	√	√	√				√	√	√	√		√		√	
AMBYSTOMATIDAE *Ambystoma laterale* Blue-spotted Salamander S4	moist woods in floodplains; ponds, sedge meadows, bogs, swamps or areas with semi-permanent water; occasionally in overgrown fields or in sandy soil; found under logs or other forest debris; home range size 250 m²	5E(11); 6E(9); 7E(1,2)	√	√	√				√	√	√	√		√			
AMBYSTOMATIDAE *Ambystoma maculatum* Spotted Salamander S4	prefers well-drained, upland deciduous, mixed forest adjacent to permanent or temporary pools; marshes, wet meadows, ponds, or streams; adults hide under stones, boards or fallen logs	3E; 3W; 4E; 5E; 6E; 7E	√	√	√				√	√	√	√		√			
AMBYSTOMATIDAE *Ambystoma texanum*[illegible] Smallmouth Salamander S1	damp, hardwood forest; temporary ponds; in burrows; underneath forest debris	7E(1) Pelee Island	√	√					√	√	√			√		√	
PLETHODONTIDAE *Desmognathus fuscus* Northern Dusky Salamander S1	riparian woodlands; cool running water, clear rocky streams with springy banks; seepage areas; hides under areas of moist debris	7E(3,5) (Niagara River Region)	√		√				√			√	√			√	
PLETHODONTIDAE *Eurycea bislineata* Northern Two-lined Salamander S4	wet coniferous, deciduous or mixed riparian habitats next to clear rocky brooks or streams; boggy areas near springs or seeps; wet woodlands or pasture; found under leaf litter or debris at water's edge; coarse sand or gravel banks; may congregate in winter in springs and cold-flowing streams and adjacent unfrozen soil; several females may use same nest site; home range size 14 m²	2E; 5E; 5E; 6E(10,11,12)	√	√	√						√	√		√			
PLETHODONTIDAE *Hemidactylium scutatum* Four-toed Salamander S4	wet deciduous, or coniferous woodlands with sphagnum moss; bogs, shallow marshes and fens; shallow woodland ponds	5E(4,7,8); 6E(9,10,12); 7E(2,3,4,5,6)	√							√	√			√			
PLETHODONTIDAE *Plethodon cinereus* Northern Redback Salamander S5	mixed, coniferous or deciduous forest; lives in decaying logs or stumps, or under stones, leaf litter and bark; bogs; derelict buildings or debris; avoids wet areas	3E; 3W; 4E; 4W; 5E; 6E; 7E						√	√	√	√						
PROTEIDAE *Necturus maculosus* Common Mudpuppy S4	rivers, lakes, bays; shallow waters under debris; completely aquatic; nocturnal; does not hibernate	4E; 4W; 5E; 6E; 7E	√	√													
SALAMANDRIDAE *Notophthalmus viridescens louisianensis* Central Newt S4?	ponds with abundant submerged vegetation; weedy sections of lakes, rivers and deep marshes; live under damp leaves, brush piles, logs or stumps in coniferous or deciduous forests; prefers beech-maple-hemlock woods or oak-pine woods	3W; 4W; 4S; 5S	√	√	√			√	√	√	√			√			
SALAMANDRIDAE *Notophthalmus viridescens viridescens* Red-spotted Newt S5	ponds with abundant submerged vegetation; weedy sections of lakes, rivers and deep marshes; live under damp leaves, brush piles, logs or stumps in coniferous, mixed or deciduous forests; adult is aquatic; home range size 270 m²	3W; 3S; 4E; 5E; 6E; 7E	√	√	√			√	√	√	√			√			
BUFONIDAE *Bufo americanus* American Toad S5	breeds in temporary or permanent, shallow woodland pools; lives anywhere with cover, damp soil and a food supply; adults remain in forest habitat, open or residential areas	All	√	√	√		√	√	√		√			√			
BUFONIDAE *Bufo fowleri*[illegible] Fowler's Toad S2 (protected in Regulation under *Fish and Wildlife Conservation Act*)	restricted in Ontario to shores of Lake Erie; requires sandy soils for burrowing to escape sun; hibernates during winter in burrows >1m deep in sand; suitable areas are along shorelines, river valleys or beaches that provide adequate insect supply; requires shallow water for breeding	5E(7); 6E(1,7); 7E(1,2,5)	√	√	√											√	
HYLIDAE *Acris crepitans blanchardi*[illegible] Blanchard's Cricket Frog SH (protected in Regulation under *Endangered Species Act* and *Fish and Wildlife Conservation Act*)	found in old fields, swamps, prairies; breeds in sluggish creeks, temporary pools; prefers permanent ponds, swamps; seldom found far from water; hibernate on land during winter	7E(1) Pelee Island	√	√	√						√			√		√	
HYLIDAE *Hyla chrysoscelis* Cope's Gray Treefrog SR	wetlands, deep marshes and swamps, ponds; woodlands near shallow water; adults are arboreal; found on moss or lichen; on trees or shrubs; in residential areas; this species reported for Ontario but without convincing documentation; are reported just west in Manitoba	5S (Rainy River area)	√	√	√			√	√	√				√		√	
HYLIDAE *Hyla versicolor* Tetraploid Gray Treefrog S5	migrates from forests to breeding areas; breeds in deep marshes and swamps, ponds; woodlands near shallow water; often found on moss or lichen on trees or shrubs	4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√		√	√	√	√				√			
HYLIDAE *Pseudacris triseriata* Western Chorus Frog S5	roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools	5E(7,10,11); 6E; 7E	√	√	√			√	√	√	√			√			

Family Name **Scientific Name** **Common Name** **NHIC ranking** **(Special Protection Measures)**	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands / Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Seasonally Concentrated**	**Cavity User**	**Provincially Rare**	**Area Sensitive**
HYLIDAE *Pseudacris crucifer* Spring Peeper S5	cool moist woods with ponds, streams or marshes; second growth woodlots or swamps; sphagnum bogs; lowlands near ponds or swamps with aquatic debris; riparian habitat; hibernates under moss or leaves; home range size 95 m^2	2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E;7E;	√	√	√			√	√	√	√			√			
HYLIDAE *Pseudacris maculata* Boreal Chorus Frog S5	swamps, marshes, ditches or temporary pools with a border of tangled vines and shrubs; sheltered sunny places	2W; 3E; 3W; 4W; 5S	√	√	√			√	√	√	√			√			
RANIDAE *Rana catesbeiana* Bullfrog S4	live in deep, permanent water with abundant emergent plants; requires stable water levels, particularly during winter hibernation and summer spawning periods	4E; 5E; 6E; 7E	√	√	√									√			√
RANIDAE *Rana clamitans* Green Frog S5	moist woodlands near water; riparian areas; requires permanent bodies of water; lake or pond shores, stream banks, edges of shallow permanent or semi-permanent fresh water; home range size 200 m^2	2W; 3E; 3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√									√			
RANIDAE *Rana palustris* Pickerel Frog S4	requires cool water provided by groundwater seepage; permanent woodland lakes, ponds, bogs or streams, with shallow clear water and thick vegetation on borders; during summer can be found in wet pastures or fields in large concentrations; most selected habitats located within 100 m from standing water	4E; 5E; 6E; 7E	√	√	√	√					√	√		√			
RANIDAE *Rana pipiens* Northern Leopard Frog S5	wet sedge meadows, fields or forests; river floodplains; ponds, shallow marshes or weedy lake edges; during summer can be found in wet pastures or fields in large concentrations; most selected habitats located within 100 m from standing water	2W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√	√	√				√			√			
RANIDAE *Rana septentrionalis* Mink Frog S5	edges of lakes, ponds and streams; cold springs; open water with abundant lily pads; occasionally in bogs or marshes	2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√						√	√					
RANIDAE *Rana sylvatica* Wood Frog S5	moist coniferous woods; wooded areas with small ponds; swamps; upland hardwood forests; flooded meadows hibernates under moist debris or in flooded meadows; home range size 66 m^2	All	√	√				√	√	√	√						

Table G - 2: Habitat descriptions for native Ontario reptiles[1].

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Seasonally Concentrated	Cavity User	Provincially Rare	Area Sensitive
CHELYDRIDAE *Chelydra serpentine* Snapping Turtle S5	permanent, semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddy banks or bottoms; often uses soft soil or clean dry sand on south-facing slopes for nest sites; may nest at some distance from water; often hibernate together in groups in mud under water; home range size ~28 ha	4E; 5E; 6E; 7E	√	√	√									(√)[2]			
EMYDIDAE *Chrysemys picta belli* Western Painted Turtle S4	quiet, warm, shallow water with abundant aquatic vegetation such as ponds, large pools, streams, ditches, swamps, marshy meadows; eggs are laid in sandy places, usually in a bank or hillside, or in fields; bask in groups; not territorial	3E; 3S; 4W; 4S; 5S	√	√	√	√					√			(√)			
EMYDIDAE *Chrysemys picta marginata* Midland Painted Turtle S5	quiet, warm, shallow water with abundant aquatic vegetation such as ponds, large pools, streams, ditches, swamps, marshy meadows; eggs are laid in sandy places, usually in a bank or hillside, or in fields; basks in groups; not territorial	4E; 5E;6E;7E	√		√						√			(√)			
EMYDIDAE *Clemmys guttata*$^{\text{V(COSEWIC; COSSARO)}}$ Spotted Turtle S3 (protected in Regulation under *Fish and Wildlife Conservation Act*)	unpolluted, shallow bodies of water such as streams, ponds, wet meadows, marshes or swamps with aquatic vegetation, logs or clumps of vegetation for basking; nest is dug near water in fine-textured soil (e.g. sand) or moss; vulnerable to factors affecting water quality, vegetation composition and structure; average home range size 3.7 ha	5E;(7); 6E;7E	√	√	√						√					√	√
EMYDIDAE *Clemmys insculpta*$^{\text{V(COSEWIC, OMNR)}}$ Wood Turtle S2 (protected in Regulation under *Fish and Wildlife Conservation Act*)	slow-moving streams with sandy bottoms and woody edges; ponds, marshes, swamps; woodlands in floodplains; lives within 150m of stream shores; home range may be 5 to 25 ha, sometimes as much as 115 ha; riparian corridors important since this species is quite terrestrial	4E; 5E(4,9,10,11); 6E(1,2,6,9,10,11,12); 7E(2,3)	√	√	√	√			√	√						√	√
EMYDIDAE *Emydoidea blandingii* Blanding's Turtle S4	shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps, or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs; not readily observed	4E; 5E; 6E; 7E	√	√	√						√						
EMYDIDAE *Graptemys geographica* Common Map Turtle S4	large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water; home range size is larger for females (about 70 ha) than males (about 30 ha) and includes hibernation, basking, nesting and feeding areas; aquatic corridors (e.g. stream) are required for movement; not readily observed	3E; 5E(4,7,12); 6E(6,10, 13,15); 7E	√	√	√						√			(√)			√
KINOSTERNIDAE *Sternotherus odoratus* Common Musk Turtle S4	aquatic, except when laying eggs; shallow slow moving water of lakes, streams, marshes and ponds; hibernate in underwater mud, in banks or in muskrat lodges; eggs are laid in debris or under stumps or fallen logs at waters edge; often share nest sites; sometimes congregate at hibernation sites; not readily observed	5E(4,7,8,11); 6E; 7E	√	√	√						√			(√)			
TRIONYCHIDAE *Apalone spinifera spinifera*$^{\text{T(COSEWIC; COSSARO)}}$ Eastern Spiny Softshell S3 (protected in Regulation under *Fish and Wildlife Conservation Act*)	intolerant of pollution; large river systems, shallow lakes and ponds with muddy bottoms and aquatic vegetation; basks on sandbars, mud flats, grassy beaches, logs or rocks; eggs are laid near water on sandy beaches or gravel banks in areas with sun; requires acceptable feeding, nesting, habitat and natural, undisturbed corridors between these critical habitats	5E(12); 6E(15); 7E	√	√	√						√					√	√
SCINCIDAE *Eumeces fasciatus*$^{\text{V(COSEWIC)}}$ Five-lined Skink S3 (protected in Regulation under *Fish and Wildlife Conservation Act*)	moderately dense or open deciduous or mixed woodlands with logs and slash piles; damp spots under logs, leaf litter, or sawdust; open talus slopes, barren rock; sandy beaches of Lake Erie, Lake Ontario; breeds in forest floor litter; lays, protects eggs under rocks, logs; forages in open woodlands, in sandy areas, along shores of lakes, and islands; hibernates under rock piles, in rock crevices, under logs and in stumps	5E(7,8,11); 6E(1,6,8,9,10,11); 7E(1,2)			√			√	√	√	√		√			√	
COLUBRIDAE *Coluber constrictor flaviventris*$^{\text{E(COSEWIC)}}$ Blue Racer S1 (protected in Regulation under *Endangered Species Act*)	abandoned fields, grassland, sparse brushy areas along prairie land, open woodland; hibernates in rock crevices in large numbers and with other species	7E(1) Pelee Island (mainland population of Point Pelee extirpated)				√		√		√	√			√	√	√	
COLUBRIDAE *Diadophis punctatus* Ringneck Snake S4	moist shady woodlands with lots of cover; stony woodland pasture; shrubby old fields; under rocks, logs or debris and in stone walls or old junk piles; eggs are laid in or under logs or stones; several females may use the same nest	4E; 5E; 6E; 7E						√	√	√	√			√	√		
COLUBRIDAE *Elaphe obsoleta obsoleta*$^{\text{T(COSEWIC)}}$ Black Rat Snake S3	shrubby, old field, deciduous or mixed forests, thickets, field edges, rocky hillsides, river bottoms; talus slopes; uses talus slopes, unused wells or cisterns for hibernation; will hibernate in groups with other snakes	5E(11); 6E(10,11,15); 7E(1,2,3,5)	√			√		√	√	√	√		√	√	√	√	√
COLUBRIDAE *Elaphe gloydi*$^{\text{T(COSEWIC)}}$ Eastern Fox Snake S3	shrub swamps and bogs; deciduous forest containing openings with shrubs and saplings; prefer woodland-marsh edges for hunting, breeding; in Lake Erie area, often seen near or adjacent to large marshes	5E(3,4,7,8); 6E(1,2,4,7,14); 7E(1,2,4)	√		√	√		√	√	√	√				√	√	

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Seasonally Concentrated	Cavity User	Provincially Rare	Area Sensitive
COLUBRIDAE *Heterodon platirhinos*$^{\text{(COSEWIC; COSSARO)}}$ Eastern Hognose Snake S3 (protected in Regulation under *Fish and Wildlife Conservation Act*)	sandy upland fields, pastures, savannahs, sandy beaches; dry open oak-pine-maple forest with sandy soils; prefer forest areas > 5ha	4E; 5E(3,4,5,7,8); 6E(2,5,6,7,9);7E			√	√		√	√	√	√					√	√
COLUBRIDAE *Lampropeltis triangulum* Milk Snake S4	farmlands, meadows, hardwood or aspen stands; pine forest with brushy or woody cover; river bottoms or bog woods; hides under logs, stones, or boards or in outbuildings; often uses communal nest sites	5E(7, 11,12)6E; 7E	√		√	√		√	√	√	√			√			
COLUBRIDAE *Nerodia sipedon insularum*$^{\text{(COSEWIC)}}$ Lake Erie Water Snake S2 (protected in Regulation under *Endangered Species Act*)	inhabit shoreline except during hibernation; prefer shrub and tree line along beaches and rocky shores; hibernation occurs away from water in abandoned quarries, deserted cisterns or closer to water along rocky shore ledges; habitat destruction is main limiting factor	7E(1) Pelee Island		√	√											√	
COLUBRIDAE *Nerodia sipedon sipedon* Northern Water Snake S5	near rivers, brooks, wet meadows, ponds, swamps, bogs or old quarries; around spillways and bridges; uses branches or logs overhanging water or emergent boulders for basking	4E; 5E; 6E; 7E	√	√	√						√			(√)			
COLUBRIDAE *Regina septemvittata*$^{\text{(COSEWIC)}}$ Queen Snake S2	margins of streams with slow currents and gravel bottoms; shorelines with rocks and debris; old quarries; canals; aquatic habitat with overhanging trees, particularly willows	7E(1,2)	√	√	√									√		√	
COLUBRIDAE *Storeria dekayi* Brown Snake S5	urban or rural areas; vacant lots or trash piles; parks or damp mixed or deciduous woods; swamps or wet meadows; clearings, cultivated lands, pastures or open fields; hides under stones, banks, logs, brush or leaf piles; hibernates in groups in ant hills or abandoned mammal burrows	5E(7,8,9,11); 6E(1,2,3,4,5,6,7,8,9,10); 7E	√			√	√			√	√			√	√		
COLUBRIDAE *Storeria occipitomaculata* Redbelly Snake S5	moist woods and hillsides, woodlands with pine, oak-hickory, aspen or hemlock groves; occasionally in sphagnum bogs, shrubby swamps, marshes, and wet meadows; river valleys; debris and abandoned buildings	5E; 5S; 6E; 7E	√		√			√	√		√				√		
COLUBRIDAE *Thamnophis butleri*$^{\text{(COSEWIC)}}$ Butler's Garter Snake S2	wet meadows, pastures, margins of marshes and streams, and open country	7E(1,2)	√		√	√	√								√	√	
COLUBRIDAE *Thamnophis sauritus* Ribbon Snake S4	sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows, grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups	5E(7,8,11,12); 6E(2,5,7,8,9,10,11,14); 7E	√	√	√	√					√			√	√		
COLUBRIDAE *Thamnophis sirtalis sirtalis* Eastern Garter Snake S5	moist areas, stream and swamp borders, bogs or marshes; wood edges or fencerows; vacant lots; hibernates in holes, crevices, anthills, mud, rotted wood, uprooted trees, or house foundations; hibernates in groups	All except 1E	√	√	√	√	√	√		√	√			√	√		
COLUBRIDAE *Thamnophis sirtalis parietalis* Red-sided Garter Snake S4?	near flowing water; tall grass; decaying leaves; hibernates in groups; known to travel several kilometres (3.5 km) to hibernation site	3S; 4S; 5S	√	√	√	√		√			√			√	√		
COLUBRIDAE *Liochlorophis vernalis* Smooth Green Snake S4	grassy open fields or meadows; open aspen stands; other hardwood stands; sphagnum bogs or marshes; found in vines, brambles; nest sites may be used by several females	4E; 5E; 6E; 7E	√		√	√		√			√			√	√		
VIPERIDAE *Sistrurus catenatus catenatus*$^{\text{(COSEWIC; COSSARO)}}$ Eastern Massasauga Rattlesnake S3 (protected in Regulation under *Fish and Wildlife Conservation Act*)	use upland, old field in summer; marsh, shrub swamp or bog; rivers and streams that provide sedge or low vegetative growth; in fall and winter; hibernate underground in mammal burrows, under rotting stumps, in rock crevices	5E(2,3,4,7,8); 6E(2,4,5,8,9,14);7E(5)	√	√	√	√		√		√	√				√	√	

---

[1] The Eastern Box Turtle, *Terrapene carolina*, and Slider, *Trachemys scripta* are not believed to be native components of Ontario's fauna and are therefore not included in this list.

[2] (√) denotes that a species may or may not exhibit (1) a certain behaviour; or, (2) a particular habitat preference

Table G - 3: Habitat descriptions for native Ontario birds.

Family Name **Scientific Name** **Common Name** **NHIC Ranking** **(Special Protection Measures)**	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands,/ Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Colonial**	**Cavity Nester**	**Provincially Rare**	**Area Sensitive**
GAVIIDAE – Loons *Gavia immer* Common Loon S5B	large bodies of water with stable water levels and little human disturbance; freshwater lakes in open or densely-forested areas; shallow coves of larger lakes; deep marshes; need long stretches of water for take off	All except 7E	√	√	√												√
COLYMBIDAE – Grebes *Podilymbus podiceps* Pied-billed Grebe S4B	areas with open water, emergent aquatic vegetation; densely vegetated marshes or shrub-bordered swamps with open water; ponds with emergent shoreline vegetation; marshy inlets and bays of large lakes; each pair requires 1 to 3 ha of breeding territory; habitat loss is a serious threat to this species	All except 1E	√	√	√												
COLYMBIDAE – Grebes *Podiceps auritus* Horned Grebe S1S2B	deep water marshes or sloughs with a mix of open water, emergent vegetation; small freshwater ponds or protected bays of larger lakes with emergent vegetation; territories are about 1 ha, but birds are very territorial	1E; 7E	√	√	√											√	
COLYMBIDAE – Grebes *Podiceps grisegena* Red-necked Grebe S3B	permanent freshwater lakes with a fringe of aquatic emergent vegetation; marshes, impoundments or sewage lagoons with > 4 ha of open water; protected marshy areas or bays in larger lakes; nest greatly affected by wave action of boats and other human disturbances	2E; 2W; 3E; 3W; 3S; 4E; 4S; 5E(1,2,3); 5S; 6E(5)	√	√	√											√	√
PELECANIDAE - Pelicans *Pelecanus erythrorhynchos*$^{E(ESA)}$ American White Pelican S3 (protected in Regulation under *Endangered Species Act*)	small, remote bedrock islands in freshwater permanent lakes; sparsely vegetated with grasses, nettles, shrubs, trees; intolerant of disturbance; colonial nester often with Double-crested Cormorants and Herring Gulls	5S		√										√		√	
PHALACROCORACIDAE - Cormorants *Phalacrocorax auritus* Double-crested Cormorant S4B	undisturbed shores or islands of large lakes; sometimes smaller inland lakes; nests in colonies often with gulls and herons; returns to same nesting site	All except 1E; 2E	√	√										√			
ARDEIDAE - Herons, Bitterns *Botaurus lentiginosus* American Bittern S4B	marshes, wet meadows, swamps, bogs with tall marsh vegetation like cattails, bulrushes; slow-flowing rivers, streams with dense bordering vegetation and thickets of alder, willow; intolerant of human disturbance, loss of wetland habitat	All	√		√	(√)											√
ARDEIDAE - Herons, Bitterns *Ixobrychus exilis*$^{V(COSEWIC)}$ Least Bittern S3B	deep marshes, swamps, bogs; marshy borders of lakes, ponds, streams, ditches; dense emergent vegetation of cattail, bulrush, sedge; nests in cattails; intolerant of loss of habitat and human disturbance	4S; 5E; 5S; 6E; 7E	√	√	√									(√)		√	√
ARDEIDAE - Herons, Bitterns *Ardea herodias* Great Blue Heron S5	wetlands, shores of ponds and lakes, marshes, standing trees in open water, swamps, including woodlots; require tall trees for nesting	All but 1E	√		√					√				√			
ARDEIDAE - Herons, Bitterns *Egretta alba* Great Egret S2	open swamp woods or willow thickets, offshore islands, mudflats for feeding; nests in standing trees in open water, thickets, sometimes low vegetation on islands or in rookeries of other herons and egrets	6E(1,2,3,4,5,6,14); 7E(1,2)	√	√	√									√		√	
ARDEIDAE - Herons, Bitterns *Butorides virescens* Green Heron S4	wetlands with heavy cover, woodland pools, streams or rivers, brushy drainage ditches, streamside thickets, conifer plantations; commonly a solitary nester	4E; 5S; 5E; 6E; 7E	√		√					√				√			
ARDEIDAE - Herons, Bitterns *Nycticorax nycticorax* Black-crowned Night Heron S3	deciduous woodland swamps, cattail marshes, islands, wooded river and lake banks, coastal wetlands	5E(2,3,7,8,11); 6E; 7E	√		√									√		√	
CATHARTIDAE - Vultures *Cathartes aura* Turkey Vulture S4	bottomland hardwood forests and thickets, rocky cliffs, various habitats, except heavy unbroken forest; roost in tall woods of live or dead trees with limbs >18 inches diameter; feed on carrion	3E; 3W; 3S; 4E;4W;4S;5E;5S; 6E;7E	√					√	√	√	√		√				
ANSERINAE - Geese *Branta canadensis* Canada Goose S5	open or forested areas near water; marshes, woody swamps; riparian habitat, shores of ponds, lakes or rivers; bogs and fens; generally nests <100m from water; strong nest site fidelity; there is concern for south James Bay and Atlantic populations of this species	All	√	√	√	√	√										
ANSERINAE - Geese *Branta bernicla* Brant S4N	tundra, braided river mouths, coastal areas with hummocks, near shallow ponds; nest on small islands in marshy pond areas in loose colonies or singly; often found with Eider Ducks; considered transients in southern Ontario	Great Lakes Region during migration; 1E in summer	√	√										√			
ANATINAE - Surface-feeding ducks *Aix sponsa* Wood Duck S5	mature wooded swamps, shallow wetlands with emergent vegetation and forested edges; open woodland near ponds or rivers; nest trees greater than 40 cm diameter (dbh); readily uses nest boxes	3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√				√	√					√		
ANATINAE - Surface-feeding ducks *Anas strepera* Gadwall S4	open areas near water, large open marsh wetlands; nests in tall, dense vegetation; islands are preferred nesting locations, occasionally with colonies of gulls or terns; sometimes feed on grain stubble of fields	1E; 2E; 3E; 3W; 3S; 4S; 4W; 5E(2,3,5,7); 6E; 7E	√	√	√	√											
ANATINAE - Surface-feeding ducks *Anas americana* American Wigeon S4	uplands associated with water; also bogs, marshes or wet meadows; open coniferous woods; islands; open shallow water such as lakes and ponds; needs emergent vegetation, especially sedges; nests are 15-50 m from water but found as far as 400 m away	All	√	√	√												
ANATINAE - Surface-feeding ducks *Anas rubripes* American Black Duck S4	forested shallow wetlands, marshes or swamps; woodland lakes or streams; mixed wood forests; islands; marshy borders of lakes and rivers; nest sometimes some distance from water; decrease in population most severe in southern portion of province	All	√	√	√	√				√							
ANATINAE - Surface-feeding ducks *Anas platyrhynchos* Mallard S5	shallow wetlands, edges of marshes, grassy wet meadows, islands, small ponds or lakes, rivers or streams; nests may be considerable distance from water	All	√	√	√	√	√										

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
ANATINAE - Surface-feeding ducks *Anas discors* Blue-winged Teal S5	shallow open wetlands, ponds or lakes; margins of rivers, marshes near grasslands or open woodland; hillside thickets	All	√	√	√	√		√									
ANATINAE - Surface-feeding ducks *Anas clypeata* Northern Shoveler S3S4	short grassy areas such as meadows or hay fields, close to open water with lots of aquatic vegetation; marshes, sloughs; nests typically 20-60 m from water but may be up to 1.6 km away; migrate in small flocks	1E; 2E; 3E; 4E; 4W; 5E(2,4,5,9); 6E; 7E	√	√	√	√											
ANATINAE - Surface-feeding ducks *Anas acuta* Northern Pintail S5	shallow marshes, swamps or ponds; tundra; meadows near water; islands; open country with low, sparse vegetation; maximum distance of nest from open water in Ontario 90-100 m but averages 40 m; frequently feeds on grain stubble	All except 4S	√		√												√
ANATINAE - Surface-feeding ducks *Anas crecca* Green-winged Teal S4	marshes, rivers, lakes or ponds, shorelines; nests in upland areas, dense stands of grass or brush from 36-100 m from wetland edge; nest occasionally found far from water	All	√	√	√												
AYTHYINAE - Diving ducks *Aythya valisineria* Canvasback S1	large marshes for nesting; prefer deep, permanent water-bodies for feeding and courtship	3S;6E(5);7E(1)	√	√												√	√
AYTHYINAE - Diving ducks *Aythya americana* Redhead S2	shallow cattail/bulrush marshes, lakes and ponds and fens; preferred nesting usually close to shallow water (most within 2 m), but can be found as far as 266 m from water's edge	3S; 5E(4,5); 6E;7E(1,2)	√	√												√	√
AYTHYINAE - Diving ducks *Aythya collaris* Ring-necked Duck S4	small (<4 ha) wetlands with some surrounding woody vegetation, often in heavily forest areas; shallow swamps, marshes and bogs with emergent vegetation; near ready lakes or rivers; during migration also rivers, larger lakes, ponds with marshy edges	2E; 2W; 3E; 3S; 3W; 4E; 4S; 4W; 5E; 5S; 6E	√	√	√												
AYTHYINAE - Diving ducks *Aythya affinis* Lesser Scaup S4	tundra ponds, inland boreal wetlands; Great Lakes inland marshes; open grassy areas near water with little emergent vegetation	1E; 2E;2W;3E;3W;4E;4S; 5S;6E(1,2,3,4,5,6,11,12,13,14,15); 7E(2,3,6,15)	√	√	√												
AYTHYINAE - Diving ducks *Bucephala albeola* Bufflehead S3B	forested lakes, ponds; sheltered bays of rivers and lakes during migration; nests in tree cavities and will use nest boxes	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4S; 5E(1); 5S	√	√	√					√					√	√	
AYTHYINAE - Diving ducks *Bucephala clangula* Common Goldeneye S5	wetlands, rivers or lakes with deep (~2 m) water; open lakes with nearby woodlands and marshy edges; bulrush in water 1m deep; breeding distribution depends on availability of trees >30 cm diameter (dbh)	1E; 2E; 2W; 3E; 3S; 3W; 4E; 4S; 4W; 5E	√	√	√				√	√					√		√
MERGINAE - Mergansers *Mergus merganser* Common Merganser S5	clear, freshwater ponds, lakes, and rivers with forested edges; riverine wetlands; clear water is preferred and is probably necessary for feeding; nests in tree cavities and snags, but may use crevices in cliffs or nest on ground; trees must be >50 cm diameter (dbh); nests <200 m from water; feed on fish	All	√	√	√				√	√			√		√		√
MERGINAE - Mergansers *Lophodytes cucullatus* Hooded Merganser S?	woodland ponds and river; remote waterways; nests in tree cavities at edge or over water; trees must be >38 cm diameter (dbh); nests <50m from water; feed on fish, invertebrates	All but 1E	√	√	√				√	√					√		
MERGINAE - Mergansers *Mergus serrator* Red-breasted Merganser S5	lakes, ponds, rivers or streams in forested areas, large deep swamps, rocky islands with shrubby growth or lake and river shorelines; nests on the ground under dense shrubbery, rocks or driftwood <50 m to water	All except 6E(12)	√	√													√
ERISMATURINAE - Ruddy, masked ducks *Oxyura jamaicensis* Ruddy Duck S2	open habitat near wetlands with emergent vegetation; nest situated above shallow water in reeds, cattails, sedges; somewhat colonial; returns to same place to nest year after year	4E; 5E(4,5,11); 5S; 6E(1,7,8,10,11,12,13); 7E(1,2,5,6)	√				√							(√)		√	
PANDIONIDAE - Ospreys *Pandion haliaetus* Osprey S4B	associated with lakes, rivers; nests in trees near water's edge or over water; will use artificial structure; may nest in small, loose colonies	All	√	√										(√)			
BUTEONINAE (in part) - Eagles *Haliaeetus leucocephalus*[illegible] Bald Eagle S3B (protected in Regulation under *Endangered Species Act*)	require large continuous area of deciduous or mixed woods around large lakes, rivers; require area of 255 ha for nesting, shelter, feeding, roosting; prefer open woods with 30 to 50% canopy cover; nest in tall trees 50 to 200 m from shore; require tall, dead, partially dead trees within 400 m of nest for perching; sensitive to toxic chemicals	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E(1,2,3,7); 5S; 7E(1)		√					√	√						√	√
CIRCINAE - Harriers *Circus cyaneus* Northern Harrier S4B	open country with herbaceous or low woody vegetation for nesting; open agricultural fields; wetlands (marshes, bogs); fresh, saltwater marshes; wet meadows; each pair requires at least 640 ha of foraging area; prefers areas > 30 ha; loss of grassland, wetland area is a threat to this species	All	√			√											√
ACCIPITRINAE - Accipiters *Accipiter striatus* Sharp-shinned Hawk S4B	dense, coniferous or mixed forests; usually near a lake or river; sometimes wet forest; uses more open areas like forest edges or forest clearings for hunting; requires minimum of 4 ha of dense (>80%) canopy closure for nesting; forests >30 ha appear to be preferred	All	√	√					√	√							√
ACCIPITRINAE - Accipiters *Accipiter cooperii* Cooper's Hawk S4B	dense, extensive mixed or deciduous forests, preferably in Carolinian forest zone; usually near pools of water or streams; woodlots interspersed with open fields; floodplain forests and wooded swamps; will nest near human activity where habitat and food are available; nesting territory must be at least 6 ha with 60 to 70% canopy closure; hunting territory extends over 3 to 5 km^2; requires minimum of 10 to 15 ha of habitat, but prefers forests > 50 ha	3E;3W;3S;4E;4S;5E;5S; 6E;7E	√						√								√

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Snags	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
ACCIPITRINAE - Accipiters *Accipiter gentilis* Northern Goshawk S4B	extensive, deciduous, coniferous or mixed mature or old growth forest with variety of shrubs, understory trees; usually near water; each pair requires 10 to 20 km² of suitable hunting habitat; a minimum of 12 ha of mature to old growth / mature woods is required for nesting; seldom found in forests < 100 ha	All	√	√					√			√					√
BUTEONINAE (in part) - Buteos *Buteo lineatus* [illegible] Red-shouldered Hawk S4B	moist, mature hardwood forests ; woody swamps or wooded margins of marshes, wet bottomlands; restricted to mature, closed (>80%) closed forests; nests reused; requires a minimum of 10 ha of continuous forest to meet territorial requirements; prefers >100 ha of forest; tends to nest in interior	3E; 4E; 5E; 6E; 7E	√						√							√	√
BUTEONINAE (in part) - Buteos *Buteo platypterus* Broad-winged Hawk S5B	nest in dense, extensive forests deciduous or mixed forests but rarely in coniferous; birch/aspen preferred over maple; nests near water or forest edges; home range is as much as 2.5 km²; prefers forest >100 ha	All except 1E	√		√			√	√	√							√
BUTEONINAE (in part) - Buteos *Buteo jamaicensis* Red-tailed Hawk S5B	dry, deciduous, coniferous or mixed woodlands or hedgerows near open country such as meadows, agricultural lands, brushy pastures; open bogs or swampy areas; isolated trees in fields ; needs large trees for nesting and perching	All				√		√	√	√							
BUTEONINAE (in part) - Eagles *Aquila chrysaetos* [illegible] Golden Eagle S1B (protected in Regulation under *Endangered Species Act*)	wild, arid plateaus, deeply cut by streams and canyons or sparsely treed slopes and rock crags	1E; possibly 4E		√									√			√	
FALCONINAE - Falcons *Falco sparverius* American Kestrel S4N	open country or grasslands with scattered trees; needs low vegetation and elevated perches; forest edges; scarce in boreal forest; require trees >30 cm in diameter (dbh) or snags	All				√				√					√		
FALCONINAE - Falcons *Falco columbarius* Merlin S4B	open forest or heavy timber; mixed woods and plantations; marshes or bogs; cliffs; needs nearby open country such as grassland, old fields or pastures for hunting; nests on ledge, tree cavities or old nest of other birds; requires dead or live trees > 30 dbh; may nest in cities	All but 7E				√	√	√		√			√		(√)		
FALCONINAE - Falcons *Falco peregrinus* [illegible] Peregrine Falcon S2B (protected in Regulation under *Endangered Species Act*)	rock cliffs, crags, especially situated near water; tall buildings in urban centres; threatened by chemical contamination; reintroduction efforts have been attempted in numerous locations throughout Ontario	5E(11)		√									√			√	
TETRAONIDAE - Grouse *Bonasa umbellus* Ruffed Grouse S5	dry, deciduous forests with dense woody overhead cover , herbaceous ground cover; prefers second growth stands of poplar; requires sunny, open areas; uses fallen logs for drumming and cover for nesting	All						√		√	√						
TETRAONIDAE - Grouse *Dendragapus canadensis* Spruce Grouse S5	dense stands of conifers, young jack pine, upland black spruce forests on stream borders; tamarack swamps, cedar bogs; muskegs; nests on ground under woody debris	All except 6E; 7E							√	√	√						
TETRAONIDAE - Grouse *Tympanuchus phasianellus* Sharp-tailed Grouse S4	wet meadows, bogs, fens, muskegs or open fields with shrubs and scattered trees; grasslands and shrubby areas on limestone plains; logged or burned-over areas; open habitat in extensive forest should be at least 2.5 km²	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4S; 5E(1,2,3,4); 5S	√			√	√										√
MELEAGRIDIDAE - Turkeys *Meleagris gallopavo* Wild Turkey S3S4	large variety of successional stages, mix of trees and grasses, spring seeps, south facing slopes, timbered corridors; grassy areas; reintroduced over much of its historical range	5E(11,12); 6E(1,5,7,9,10,11,12,15); 7E(2,6)				√		√	√	√	√	√					
PHASIANIDAE - Partridges, quails, pheasants *Colinus virginianus* [illegible] Northern Bobwhite S1S2	grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs, fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges	6E(1, 15); 7E				√		√		√						√	
RALLIDAE - Rails, gallinules, coots *Coturnicops noveboracensis* [illegible] Yellow Rail S3S4B	large, freshwater or brackish grass and sedge marshes with dense vegetation including bulrushes, horsetails, grasses; loss of wintering habitat and southern wetlands is limiting to this species	1E; 2E; 2W; 5E(1,2); 5S; 6E(8,11,12,13)	√														√
RALLIDAE - Rails, gallinules, coots *Rallus elegans* [illegible] King Rail S2B	large, shallow, fresh water marshes, shrubby swamps, marshy borders of lakes and ponds with abundant vegetation; an 'edge' species; territories are 0.3 to 0.5 ha; loss of large marshes in the south is limiting to this species	6E(8,9,13); 7E(1,2)	√		√											√	√
RALLIDAE - Rails, gallinules, coots *Rallus limicola* Virginia Rail S4B	freshwater, shallow marshes, sloughs or roadside ditches with a mix of open water; emergent vegetation (sedges, cattails); wetlands and ponds, lakes with sedge and cattail edge; fluctuating water levels are a threat to nests; territories are from 0.25 to 1 ha in size	3E; 3W; 3S; 4E; 4W; 4S; 5E; 6E; 7E	√	√	√												
RALLIDAE - Rails, gallinules, coots *Porzana carolina* Sora S4B	densely vegetated marshy habitats: cattail, grassy marshes, bogs, fens, swamps, wet grassy meadows; ponds with abundant aquatic emergent vegetation; prefers areas of deep mud and water ; rising and lowering water levels are a threat to nests; loss of wetland habitat is a threat to species	All	√	√	√												
RALLIDAE - Rails, gallinules, coots *Gallinula chloropus* Common Moorhen S4B	deep, freshwater marshes with sheltered pools, channels; emergent vegetation growing in water >0.3 m deep; sewage lagoons, impoundments; any body of deep water with emergent vegetation	5E(7,8,9,10,11); 6E; 7E	√	√													

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
RALLIDAE - Rails *Fulica americana* American Coot [illegible]	reed marshes with permanent water and tall emergent vegetation; needs deep open water; cattail marshes; near lakes or ponds; more or less colonial nester; territories small (0.3 ha) in productive habitat; limited by shortage of habitat	3S; 3W; 4E; 4W; 5E(1,2,3,4,5); 5S; 6E; 7E	√	√										(√)			√
GRUIDAE - Cranes *Grus canadensis* Sandhill Crane S4B	large, secluded wetlands of low shrub bogs, cattail marshes, fens, peaty wetlands with sphagnum, cattails, sedges; uses upland meadows for feeding; prefer wetlands >40 ha in size; sensitive to disturbances during nesting period	1E; 2E; 2W; 3E; 3W; 3S; 4E; 5E; 5S; 7E(1)	√			√											√
CHARADRIIDAE - Plovers, turnstones *Charadrius melodus circumcinctus* Piping Plover S1B (protected in Regulation under Endangered Species Act)	dry, sandy outer beaches; upper stretches near dunes, usually large open, grassless areas, but sometimes with sparse scattering of beach grass; recreational uses of beaches results in habitat loss	5E(7); 5S		√	√											√	
CHARADRIIDAE - Plovers, turnstones *Charadrius vociferus* Killdeer S5B	open areas such as grazed meadows, pastures, woodland clearings, lawns, golf courses, cemeteries, cultivated fields; waste places; lakeshores or edges of ponds, orchards, airports, gravel roofs	All		√	√	√	√										
SCOLOPACIDAE - Sandpipers etc. *Tringa melanoleuca* Greater Yellowlegs S4B	fens, bogs, sloughs, shallow ponds surrounded or interspersed with tree, shrub cover	1E; 2E; 2W; 3E; 3W; 3S	√	√	√												
SCOLOPACIDAE - Sandpipers etc. *Tringa solitaria* Solitary Sandpiper S4B	open, wet northern coniferous forest woodlands; wetlands, ponds; lakes; nests in abandoned bird nests in trees	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E(1,2,4,5)	√	√													
SCOLOPACIDAE - Sandpipers etc. *Actitis macularia* Spotted Sandpiper S5B	variety of habitat types near water; often forages on floating logs	All	√	√	√	√	√				√						
SCOLOPACIDAE - Sandpipers etc. *Bartramia longicauda* Upland Sandpiper S4B	open pastures, fields of alfalfa, clover, hayfields; forest clearings, extensive, dry, old grassy fields with little to no shrubs or trees; requires tracts of grassland 25-50 ha	3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E				√											√
SCOLOPACIDAE - Sandpipers etc. *Limosa fedoa* Marbled Godwit S3	wetlands, sloughs, lakes or ponds with grassy edges; feed largely on insects; protection of coastal marshes is important	1E; 2E; 5S	√	√	√	√										√	
SCOLOPACIDAE - Sandpipers etc. *Gallinago gallinago* Common Snipe S5B	large, open marshes, fens, peatlands, bogs or wet meadows with short vegetation; alder, willow swamps, thickets on pond, lake, river edges; brook and river lowlands with moist, soft organic soil and low sparse vegetation	All	√	√	√	√		√									
SCOLOPACIDAE - Sandpipers etc. *Scolopax minor* American Woodcock S5B	moist, early succession woodland; prefers aspen, alder, birch; open, grassy clearings; forest edges; swamps, bogs, streambanks; require two territories - dry, open upland singing grounds and moist, wooded areas for nesting and feeding	All except 1E; 2W	√		√			√		√	√						
PHALAROPODIDAE - Phalaropes *Phalaropus tricolor* Wilson's Phalarope [illegible]	open wetlands, ponds, lakes, marshes and sloughs with wet meadow vegetation; freshwater coastal marshes; nests on ground in loose colonies; sewage lagoons with grassy edges; feeds on land and aquatic insects; may nest in loose colonies where nests are 9 to 12m apart	2E; 2W; 4E; 5E(1,2,3,4,11); 5S; 6E; 7E	√	√	√									(√)		√	
LARINAE - Gulls *Larus minutus* Little Gull [illegible]	predominantly marshes, occasionally on islands; inland marshes and marshy border lakes; nests on floating to semi-floating mats	1E;2E; 5E(7); 6E(2,3,4,13,14)7E(1,2,3,4)	√	√										√		√	
LARINAE - Gulls *Larus philadelphia* Bonaparte's Gull S4	nests in coniferous trees (preferably spruce-fir) near muskegs, swamps, ponds or lakes; frequent lakes, rivers, marshes, coastal bays, harbours; sand bars and mud flats; feeds on fish or scavenges	1E; 2E; 2W; 3E; 3S; 3W; 4E	√	√					√					√			
LARINAE - Gulls *Larus delawarensis* Ring-billed Gull S5	small, partly vegetated islands, dykes, breakwaters, sewage lagoons, garbage dumps, lakes, rivers, open beaches, mudflats, harbours; nests in colonies on islands in lakes, rivers	All	√	√	√		√							√			
LARINAE - Gulls *Larus argentatus* Herring Gull S5	undisturbed open, rocky islands, peninsulas or cliffs along lakes or rivers; also on sand dunes or headlands with various types of shores and islands	All	√	√	√		√						√	√			
LARINAE - Gulls *Larus marinus* Great Black-backed Gull [illegible]	flat rocky coastal islands, moorlands, rocky beaches, cliffs; nest is solitary or in small (rarely large) colonies	5E(2,5); 6E(2,3,4,10,13,14,15); 7E(2,3,4)	√	√	√								√	(√)		√	
STERNINAE - Terns *Sterna caspia*[illegible] Caspian Tern S3	open habitat near large lakes or rivers, beaches, shorelines, rocky or sandy beaches, offshore islands; negatively affected by elevated water levels during nesting season; feeds on fish; found in association with Ring-billed Gulls	1E;2E; 5E(1,2,3,4,5,7); 5S; 6E(2,3,4,6,8,9,10,13,14,15); 7E(1,2,3,4)	√	√	√									√		√	
STERNINAE - Terns *Sterna hirundo* Common Tern S4	sandy and gravelly beaches or shores; small sparsely vegetated islands in larger bodies of water; occasionally grassy uplands; forage along lakeshores and large rivers	All	√	√	√									√			
STERNINAE - Terns *Sterna forsteri* Forster's Tern S3	large open and fresh or saltwater marshes, deep cattail marshes; must be near open water; marsh nesting restricts breeding distribution; eats insects as well as fish; seldom uses marshes <300 ha	3S; 4S; 5S; 7E(1,2)	√	√										√		√	√

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands / Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Colonial**	**Cavity Nester**	**Provincially Rare**	**Area Sensitive**
STERNINAE - Terns *Chlidonias niger*[illegible] Black Tern S3	wetlands, coastal or inland marshes; large cattail marshes, marshy edges of rivers, lakes or ponds, wet open fens, wet meadows; returns to same area to nest each year in loose colonies; must have shallow (0.5 to 1 m deep) water and areas of open water near nests; requires marshes >20 ha in size; feeds over adjacent grasslands for insects; also feeds on fish, crayfish and frogs	All except 1E	√	√	√	√								√		√	√
COLUMBIDAE - Pigeons, doves *Zenaida macroura* Mourning Dove S5	open, mature coniferous mixed woodlands interspersed with open areas, agricultural fields; edges, woodlots and shelterbelts; evergreen plantations or orchards; urban areas; open woodland with bare ground that produces enough food	2E; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E					√	√		√							
CUCULIDAE - Cuckoos, anis etc. *Coccyzus erythropthalmus* Black-billed Cuckoo S4B	dense, shrubby deciduous vegetation of low to medium height, interspersed with clearings; brushy pasture; shrubby hedgerows at field edges; dry open upland woods; overgrown old fields with hawthorn; swamps	2E; 3E; 3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√					√		√							
CUCULIDAE - Cuckoos, anis etc. *Coccyzus americanus* Yellow-billed Cuckoo S4B	Carolinian, Great Lakes- St. Lawrence forest zones; open woodlands with dense, shrubby undergrowth; scrub-land with small trees; orchards; parkland; edges of agricultural areas; overgrown, weedy fields; streambanks with dense thickets	5E(1,2,3,4,5,7); 6E; 7E				√	√	√		√	√						
TYTONIDAE - Barn -owls *Tyto alba*[illegible] Barn Owl S1	open areas such as fields, agricultural lands with scattered woodlots, buildings and/or orchards; grasslands, sedge meadows, marshes; snow-cover limits ability to catch prey; species has intolerance to severe cold; nests in hollow trees and live trees >46 cm dbh; also nests in barns, abandoned buildings	6E(9); 7E(3,5)	√			√							√		√	√	
STRIGIDAE - Owls *Otus asio* Eastern Screech Owl S5	open woodland, orchards or shade trees in urban areas; small woodlots; prefers mature deciduous trees; requires trees > 30 cm dbh for nesting and roosting; confined largely to southern Ontario as a breeding bird; small woodlots are acceptable if scattered trees are available over several hectares	4E; 5E(1,2,3,7,8,9,11,12); 6E; 7E	√				√		√	√					√		
STRIGIDAE - Owls *Bubo virginianus* Great Horned Owl S5	deep, deciduous, mixed or coniferous forests or large woodlots; mixed forests and fields; swamps; woodlands near large streams or pond; near dumps; feeds in open areas like fields or pastures	All	√			√		√	√	√							
STRIGIDAE - Owls *Surnia ulula* Northern Hawk Owl S3S4	open, coniferous or mixed woods with clearings; forest edges; swamps or muskega; dense bushy areas; burned woodland with standing stumps; diurnal habits; nests in old woodpecker holes	1E; 2E; 2W;3E; 3S	√						√	√					√		
STRIGIDAE - Owls *Strix varia* Barred Owl S4	coniferous or mixed woodlands with little understory and relatively closed canopy; dense moist forest, particularly near stream, river or lake; heavily wooded swamps; often near open area or clearing for hunting; requires trees with diameter >50 cm, with cavities for nesting; has home range of 10-250 ha; needs large 100 - 400 ha forests	All but 1E	√	√					√						√		√
STRIGIDAE - Owls *Strix nebulosa*[illegible] Great Gray Owl S3S4	boreal forest; various woodlands; open fields or peatlands with exposed perches for hunting; extensive muskege with interspersed tamaracks and black spruce; open fens, bogs or meadows; diurnal habits; uses abandoned crow, raven, hawk nests; home range of 100 ha or more	1E; 2E; 2W; 3E; 3W; 3S;4E; 4W; 4S; 5S	√						√	√						√	√
STRIGIDAE - Owls *Asio otus* Long-eared Owl S4	dense stands of coniferous or mixed forest; reforestation plots; isolated groves of coniferous woods on farmland; needs large open areas for foraging; winters deep in groves of evergreens	All except 2W; 3S; 4S; 4W	√						√								
STRIGIDAE - Owls *Asio flammeus*[illegible] Short-eared Owl S2	grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra; both diurnal and nocturnal habits; ground nester; destruction of wetlands by drainage for agriculture is an important factor in the decline of this species; home range 25 -125 ha; requires 75-100 ha of contiguous open habitat	All except 3W; 4W; 4S	√			√								√		√	√
STRIGIDAE - Owls *Aegolius funereus* Boreal Owl S4	boreal forest zone in mixed to pure coniferous forest; prefers spruce, balsam fir, trembling aspen, balsam poplar and white birch; open areas, such as beaver ponds, edges or natural openings for hunting; require dead or living trees with dbh >30 cm; hunting territories of open areas near edges ≥5 km²	2E; 2W;3E; 3W;3S; 4E; 4W; 4S; 5E(4); 5S	√	√					√	√					√		√
STRIGIDAE - Owls *Aegolius acadicus* Northern Saw-whet Owl S4S5B	coniferous, mixed or deciduous forests; prefers conifers; found in interior or edge of forest; requires dead trees >30 cm for nesting and roosting; also in chimneys, abandoned buildings; commonly found in urban areas	3E; 3W; 4E; 4W; 4S;5E;6E;7E					√		√	√					√		
CAPRIMULGIDAE - Goatsuckers *Chordeiles minor* Common Nighthawk S4B	open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs	All				√	√	√		√							
CAPRIMULGIDAE - Goatsuckers *Caprimulgus vociferus* Whip-poor-will S5B	dry, open, deciduous woodlands of small to medium trees; oak or beech with lots of clearings and shaded leaf-litter; wooded edges, forest clearings with little herbaceous growth; pine plantations; associated with >100 ha forests; may require 500 to 1000 ha to maintain population	3E;4E; 4W; 4S 5E; 5S; 6E; 7E				√		√	√	√	√						√
APODIDAE - Swifts *Chaetura pelagica* Chimney Swift S5B	commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys; highly gregarious; feeds over open water	2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E		√		√	√		√	√			√	√	√		
TRICHILIDAE - Hummingbirds *Archilochus colubris* Ruby-throated Hummingbird S5B	dense, mixed woodland or forest edges; shade trees or orchards in cultivated lands near a stream if possible; wooded swamps; abundant, preferably red flowers	All except 1E; 2E; 2W	√	√			√	√		√							
ALECEDINIDAE - Kingfishers *Ceryle alcyon* Belted Kingfisher S5B	sand, clay, gravelly banks within 1.6 km of water body with fish; eroded stream or river banks; lakeshore bluffs; gravel pits or road cuts close to adequate food source; needs perches near water for sighting prey	All	√	√											√		

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
PICIDAE - Woodpeckers *Melanerpes erythrocephalus*[V,V] Red-headed Woodpecker S3B	open, deciduous forest with little understory; fields or pasture lands with scattered large trees; wooded swamps; orchards, small woodlots or forest edges; groves of dead or dying trees; feeds on insects and stores nuts or acorns for winter; loss of habitat is limiting factor; requires cavity trees with at least 40 cm dbh; require about 4 ha for a territory	4E; 4S; 5E; 5S; 6E;7E	√				√		√	√	√				√	√	
PICIDAE - Woodpeckers *Melanerpes carolinus* Red-bellied Woodpecker S3S4	mature deciduous forests with numerous dead trees; open woodlands, suburbs or parks; both wet bottomland or dry upland areas; requires at least 4 ha of continuous forest and cavity trees at least 35 cm dbh	6E(1,2,5,7,8,9,13,15); 7E	√						√	√	√				√		
PICIDAE - Woodpeckers *Sphyrapicus varius* Yellow-bellied Sapsucker S5B	dry, second growth forests with dead trees >25 cm dbh for nesting; prefers live trembling aspen; dense or open deciduous or mixed birch, hemlock, maple forest with tall trees; territories are from 2-5 ha in size	All	√					√	√	√	√				√		√
PICIDAE - Woodpeckers *Picoides pubescens* Downy Woodpecker S5	mainly deciduous, sometimes mixed forests; found in areas of few, young or mature matures; small woodlots or edges with shrubs and saplings; uses dead trees >20 cm dbh; territories cover 2-4 ha	All but 1E	√				√	√	√	√	√				√		
PICIDAE - Woodpeckers *Picoides villosus* Hairy Woodpecker S5	mixed or deciduous forests; prefer mature trees, but use wide range in size and canopy cover; forest edges; requires a number of tall trees and snags; requires trees >25 cm dbh; territories cover 4-8 ha	All	√						√	√	√				√		√
PICIDAE - Woodpeckers *Picoides tridactylus* Three-toed Woodpecker S4	moist, mature or old growth coniferous woodlands of cedar-balsam fir; burns with stands of dead timber; riparian areas; bogs; loosely colonial where nesting habitat is particularly suitable and food supply abundant; uses dead trees > 30 cm dbh; needs extensive (≥40 ha) of forest	1E; 2E; 2W; 3E; 3W; 3S;4E; 4W; 4S; 5E(11); 5S; 6E(10)	√	√					√		√			(√)	√		√
PICIDAE - Woodpeckers *Picoides arcticus* Black-backed Woodpecker S4	burned over coniferous sites with standing timber; mature, old growth coniferous forests of mainly cedar-balsam fir; bogs; riparian areas; territories cover 30-40 ha	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 6E(5,13)	√	√	√				√		√				√		√
PICIDAE - Woodpeckers *Colaptes auratus* Northern Flicker S5B	open deciduous, coniferous or mixed woodlands; forest edges; suburbs, farm woodlots; wetlands; uses dead or dying trees with dbh >30 cm; very adaptable species; not dependent on forest size	All	√				√	√	√	√	√				√		
PICIDAE - Woodpeckers *Dryocopus pileatus* Pileated Woodpecker S4S5	extensive tracts of mature deciduous or mixed forest with water and large diameter (40+ cm) trees for cavity construction; both lowland, upland forests; sometimes found in more open agricultural areas and parks with large trees; area sensitive species requiring 40-260 ha; requires trees >25 cm dbh for nesting and trees 40+ cm dbh for roosting	All but 1E	√						√		√				√		√
TYRANNIDAE - Flycatchers *Contopus borealis* Olive-sided Flycatcher S5B	semi-open, conifer forest, prefers spruce; near pond, lake or river; treed wetlands for nesting; burns with dead trees for perching	All except 7E	√	√	√					√							
TYRANNIDAE - Flycatchers *Contopus virens* Eastern Wood Pewee S5B	open, deciduous, mixed or coniferous forest; predominated by oak with little understory; forest clearings, edges; farm woodlots, parks	2E; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√				√	√	√	√							
TYRANNIDAE - Flycatchers *Empidonax flaviventris* Yellow-bellied Flycatcher S5B	coniferous forest of pine and spruce with dense shrubs; shrubby swamps with spruce, alder; low, wet swampy thickets bordering ponds, streams, bogs; talus slopes	All except 7E	√		√			√		√			√				
TYRANNIDAE - Flycatchers *Empidonax virescens*[illegible] Acadian Flycatcher S2B	mature, shady, deciduous forests; heavily wooded ravines; creek bottoms or river swamps; availability of good quality habitat is limiting factor; needs at least 30 ha of forest	6E(1); 7E	√						√							√	√
TYRANNIDAE - Flycatchers *Empidonax alnorum* Alder Flycatcher S5B	open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, swamps or marshes; prefers alders, willows, elders or sumacs	All	√		√			√		√							
TYRANNIDAE - Flycatchers *Empidonax traillii* Willow Flycatcher S5B	open areas with secondary shrubby growth or low trees of willow, red osier dogwood, hawthorn; damp to dry brushy, abandoned fields or clearcuts; open forest or orchards with clearings; forest edges; hedgerows	4E; 5E; 6E; 7E						√		√							
TYRANNIDAE - Flycatchers *Empidonax minimus* Least Flycatcher S5B	open deciduous woodland or forest edges; orchards; open shrub land; clearings or overgrown pasture of >100 ha	All	√					√		√							√
TYRANNIDAE - Flycatchers *Sayornis phoebe* Eastern Phoebe S5B	suburban or agricultural areas; farmland; mature mixed, deciduous, coniferous woodlands; woodland cliffs or ravines, often near streams	2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E		√	√		√		√	√			√				
TYRANNIDAE - Flycatchers *Myiarchus crinitus* Great Crested Flycatcher S5B	broad-leafed trees in mature deciduous or mixed forests; prefers edges and clearings rather than forest interior; swamps, savannahs, old orchards; nests are in natural cavities or woodpecker holes in trees > 46 cm dbh; territories may not be more than 1 ha in size, but birds prefer rather extensive woodlands	3E; 3W; 3S;4E; 4W; 4S; 5E; 5S; 6E; 7E	√					√	√	√					√		
TYRANNIDAE - Flycatchers *Tyrannus verticalis* Western Kingbird S1B	dry, open country or scrub-land with trees; telephone poles or other perches; hedgerows; agricultural land	5S				√		√								√	
TYRANNIDAE - Flycatchers *Tyrannus tyrannus* Eastern Kingbird S5B	shrubby, forest edges; hedgerows or stream banks in or near open fields; pastures, clearings or burned over lands with sufficient perches; swamps, marshes with dead stumps or snags; open woodlands and orchards; territory about 1 ha in size	All	√		√	√		√		√							
LANIIDAE - Shrikes *Lanius ludovicianus*[illegible] Loggerhead Shrike S2B (protected in Regulation under *Endangered Species Act*)	grazed pasture, marginal farmland with scattered hawthorn shrubs, hedgerows; fence posts, wires and associated low-lying wetland; located on core areas of limestone plain adjacent to Canadian Shield; greatest threat is fragmentation of suitable habitat due to natural succession; probably needs at least 25 ha of suitable habitat	5E(11); 6E; 7E(3,8)				√										√	√

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
VIREONIDAE - Vireos *Vireo griseus* White-eyed Vireo S2B	dense, swampy thickets and hillsides with blackberry and briar tangles; forest edges, early successional fields; territories 1-2 ha	6E(1,7,13); 7E	√					√		√						√	
VIREONIDAE - Vireos *Vireo flavifrons* Yellow-throated Vireo S4B	open woods of oak, maple or other hardwoods; orchards; groves; roadside trees; rarely in conifers; requires at least 30 ha of forest area	6E; 7E	√					√	√	√							√
VIREONIDAE - Vireos *Vireo solitarius* Blue-headed Vireo S5B	large, mature coniferous or mixed forests of pine, hemlock or spruce with nearly continuous canopy and dense understory; pine plantations; either closed canopy or where trees are more scattered; require young coniferous or deciduous shrubs for nesting; often associated with swampy areas; territories <1 ha; appears to need about 100 ha of forest in the south	All except 7E(1)	√					√	√								√
VIREONIDAE - Vireos *Vireo gilvus* Warbling Vireo S5B	open, mature mixed or deciduous woodlands, orchards, shade trees; watercourse edges with scattered trees; mature deciduous trees such as maple, poplar; forest edges; woodland groves, parks; towns, cities	3E; 3W; 3S; 4E; 4S; 5E; 5S; 6E; 7E	√		√		√	√	√	√							
VIREONIDAE - Vireos *Vireo philadelphicus* Philadelphia Vireo S5B	open, deciduous, coniferous or mixed forest with trembling aspen and alders; among or adjacent to aspen groves; forest edges; streamside willow and alder thickets; burned over areas or clearings; small (0.5 ha) territory	2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E (3,4,6,8,9,10,11,12,14)	√		√			√		√							
VIREONIDAE - Vireos *Vireo olivaceus* Red-eyed Vireo S5B	open, second growth deciduous or mixed woodlands with a continuous canopy and dense understory including saplings; residential shade trees with continuous canopy; mesic stands in deciduous forest	All						√	√								
CORVIDAE - Crows, jays *Perisoreus canadensis* Grey Jay S5	coniferous, mixed wood forests, forest openings, bogs; highly territorial	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 6E(9,12)	√						√	√							
CORVIDAE - Crows, jays *Cyanocitta cristata* Blue Jay S5	coniferous, deciduous or mixed woods; regenerating forests; scrub meadow; urban habitats	All except 1E	√		√		√	√	√	√							
CORVIDAE - Crows, jays *Pica pica* Black-billed Magpie S3	prairie fringes, open agricultural, parkland or scrub-land, pastures, fields with aspen, willow, alder groves; open woodlands and thickets, especially along water courses; has close association with human, rural settlements	4S; 5S			√	√	√	√								√	
CORVIDAE - Crows, jays *Corvus brachyrhynchos* American Crow S5	deciduous, coniferous, mixed woods with adjacent open areas or farmland; edges; open fields with scattered woodlots; forests near marshes, lakes, rivers	All	√		√	√	√	√	√	√							
CORVIDAE - Crows, jays *Corvus corax* Common Raven S5	relatively undisturbed habitat of boreal or mixed forest; nests on steep cliffs or in tall trees; uses and builds onto same nest in consecutive years	All except 7E	√						√				√				
ALAUDIDAE - Larks *Eremophila alpestris* Horned Lark S4N	large, open areas with short grasses, ploughed fields, agricultural lands, pastures, prairie, golf courses, cemeteries, airports, areas of little vegetation, tundra, seashore; needs a bare patch of exposed ground within territory	1E; 2E; 3E; 3S; 4E; 5E; 5S; 6E; 7E			√	√											
HIRUNDINIDAE - Swallows *Progne subis* Purple Martin S4S5B	open, treed areas such as farmland, parks, yards, marshes; usually near large bodies of water; colonial; nests in tree cavities, cliff ledges; most common in nest boxes; requires open space for foraging; prefers trees >15 cm dbh	4E; 4W; 4S; 5E; 5S; 6E; 7E	√	√	√		√			√			√	√	√		
HIRUNDINIDAE - Swallows *Tachycineta bicolor* Tree Swallow S5B	open spaces, near open water or over water; clear cuts or farmland; requires cavity trees with dbh >25 cm; normally a solitary nester	All	√	√	√	√	√			√					√		
HIRUNDINIDAE - Swallows *Stelgidopteryx serripennis* Northern Rough-winged Swallow S5	open areas near river banks, lakeshores, gravel pits, sandy road banks, steep riparian banks, or drainage holes for nesting, and near a water supply	3E; 4E; 4S; 5E; 5S; 6E; 7E		√	√								√	√	√		
HIRUNDINIDAE - Swallows *Riparia riparia* Bank Swallow S5	sand, clay or gravel river banks or steep riverbank cliffs, lakeshore bluffs of easily crumbled sand or gravel, gravel pits, road-cuts, grassland or cultivated fields that are close to water; nesting sites are limiting factor for species presence	All		√	√								√	√	√		
HIRUNDINIDAE - Swallows *Hirundo pyrrhonota* Cliff Swallow S5	cliffs and bluffs with nearby open areas such as farmland, fields or pasture; nests built on buildings, bridges nests; open forest for feeding	All except 1E											√	√			
HIRUNDINIDAE - Swallows *Hirundo rustica* Barn Swallow S5B	farmlands or rural areas; cliffs, caves, rock niches; buildings or other man-made structures for nesting; open country near body of water	All	√	√	√	√				√			√	√			
PARIDAE - Titmice *Parus atricapillus* Black-capped Chickadee S5	small-open deciduous or mixed wooded areas (parks, residential areas); edges, thickets; nests in tree cavities of trees with dbh >10 cm; territory is 1-2 ha of woodland	All	√		√			√	√	√	√				√		
PARIDAE - Titmice *Parus hudsonicus* Boreal Chickadee S5	forests on poor soil; conifers (spruce); wooded swamps, bogs; thickets; nest in natural cavities, woodpecker holes, or their own excavation in decaying wood; territory is about 1-2 ha of woodland	1E; 2E; 3E; 3W; 3S; 4E; 4W; 4S; 5E(4,5,6,8,9,10); 5S	√					√	√		√	√			√		
PARIDAE - Titmice *Parus bicolor* Tufted Titmouse S2	mixed or deciduous forests; moist bottomlands and swamps, orchards; agricultural or urban forested areas, often near birdfeeders; Carolinian forest; nest in natural cavities or woodpecker holes in live or soft dead trees >10 cm dbh; area sensitive, requiring at least 4 ha of shrub and sapling growth near water	6E(1,6); 7E(1,2,3,5)	√				√	√		√	√				√	√	√
SITTIDAE - Nuthatches *Sitta canadensis* Red-breasted Nuthatch S5	coniferous and mixed wood forests; nests in a cavity in soft, decaying coniferous wood with dbh >12 cm; requires coniferous component to its habitat; most abundant in mature woods and relatively dense forests; nests in interior, requiring at least 10 ha of forest	All	√						√	√	√				√		√

Family Name **Scientific Name** **Common Name** **NHIC Ranking** **(Special Protection Measures)**	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands / Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Colonial**	**Cavity Nester**	**Provincially Rare**	**Area Sensitive**
SITTIDAE - Nuthatches *Sitta carolinensis* White-breasted Nuthatch S5	mature, broad-leafed woodland; tolerates mixed forest; orchards, shade trees in suburban and rural areas; uses natural cavities in trees with dbh> 30 cm; needs at least 10 ha or more of continuous forest	3E; 3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E					√		√	√	√				√		√
CERTHIIDAE - Creepers *Carthia americana* Brown Creeper S5B	mature dense, coniferous, deciduous, mixed woodlands; particularly wet areas with large dead trees; bogs; wooded swamps; older second growth forest; riparian areas; requires dead trees >25 cm dbh with loose bark for nesting; occasionally nests in tree cavity; requires a minimum of 30 ha	All	√	√					√	√					(√)		√
TROGLODYTIDAE - Wrens *Thryothorus ludovicianus* Carolina Wren S3	scrub-land; open deciduous woodland thickets and tangles along streams, woodland edges with slash piles; in winter found in sheltered stream valleys, deep ravines with nearby food source	6E(8,9,11,13,15); 7E			√		√	√		√					√	√	
TROGLODYTIDAE - Wrens *Troglodytes aedon* House Wren S5B	edges of woods, rivers, swamps or clear cuts; openings with shrubs and thickets; deciduous woods, shrubbery; gardens; orchards, swampy woodlands; nests in trees with dbh >25 cm; territories may be no more than 0.4 ha in size	3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S;6E; 7E	√				√	√		√	√				√		
TROGLODYTIDAE - Wrens *Troglodytes troglodytes* Winter Wren S5B	interior species; coniferous forest with hemlock-pine communities; cedar swamps; spruce bogs; deep woods with dense undergrowth; downed wood close to forest streams; nests in cavities of uprooted trees, old stumps, brush piles; nests in soft trees with dbh >10 cm; appears to need at least 30 ha of forest	All	√		√			√	√	√	√				√		√
TROGLODYTIDAE - Wrens *Cistothorus platensis* Sedge Wren S4B	shallow, wet sedge or grass marshes, bogs, old fields or meadows with scattered shrubs of willow, alder; little to no standing water; territories 0.2 ha in size	All except 1E	√			√								√			
TROGLODYTIDAE - Wrens *Cistothorus palustris* Marsh Wren S4S5B	large, expanses of cattail marsh with some open water; shores of sluggish rivers or streams or inland ponds with moderate density stands of tall robust emergent vegetation (sedges, cattails); gregarious; uses same breeding area year after year; constructs "cavity nest" out of cattail leaves	2E; 3S; 4E; 4S; 5E; 5S; 6E; 7E	√	√	√									(√)			
SYLVIIDAE - Gnatcatchers, kinglets *Regulus satrapa* Golden-crowned Kinglet S5B	closed, mature coniferous forest; preferably spruce, fir, hemlock, pines; mature spruce and pine plantations with average dbh >15 cm and a closed canopy; cedar bogs	All	√						√								
SYLVIIDAE - Gnatcatchers, kinglets *Regulus calendula* Ruby-crowned Kinglet S5B	coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine; evergreen stands in a variety of habitats; coniferous open or edge areas with thickets of brush; bogs	All except 7E	√					√	√	√							
SYLVIIDAE - Gnatcatchers, kinglets *Polioptila caerulea* Blue-gray Gnatcatcher S4B	Carolinian and Great Lakes-St. Lawrence Forest zones in deciduous or mixed woods; oak-pine woods or oak savannahs; open, moist woodlands with brushy clearings; bottomland forests with closed canopies; wooded swamps; stream-side thickets; needs about 30 ha of forest	6E; 7E	√		√			√	√	√							√
TURDIDAE - Thrushes, robins, etc. *Sialia sialis* Eastern Bluebird S4S5B	agricultural area, clearings, fields, pastures, lawns, cemeteries, golf courses or forest clearings; savannahs; swamps, edges; orchards; low cavities in trees >20 cm dbh; territories are 4-8 ha	2E; 3E;3S; 4E; 4W; 4S; 5E; 6E; 7E	√			√	√			√					√		
TURDIDAE - Thrushes, robins, etc. *Catharus fuscescens* Veery S5B	cool, moist, mixed and deciduous young or disturbed forest with bushy undergrowth and ferns; forest edges; wooded swamps or damp ravines; open woods with dense high undergrowth of ferns, shrubs; shows sensitivity to habitat fragmentation; needs at least 10 ha of forest	All except 1E	√					√		√	√						√
TURDIDAE - Thrushes, robins, etc. *Catharus ustulatus* Swainson's Thrush S5B	interiors of coniferous forest (spruce, fir), with deciduous shrubs; low, damp woods near water; riverbanks; young or mature stands; will use mixed woods	All except 7E	√		√				√	√							
TURDIDAE - Thrushes, robins, etc. *Catharus guttatus* Hermit Thrush S5B	boreal forest, or Great Lakes-St. Lawrence forest zones; rocky, dry, jack pine forests; dry sandy coniferous or deciduous woods with dense young undergrowth; spruce bogs; borders of wooded swamps and damp forest; brushy pasture; appears to need at least 100 ha of forest in south	All	√					√	√	√	√						√
TURDIDAE - Thrushes, robins, etc. *Hylocichla mustelina* Wood Thrush S5B	Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges; must have some trees higher than 12 m	3E; 3W; 4E; 4W; 5E; 6E; 7E						√	√	√	√						
TURDIDAE - Thrushes, robins, etc. *Turdus migratorius* American Robin S5B	residential areas, lawns, gardens, ornamental trees, shrubberies; forest edges and openings, burns, cut-over areas; fens, bogs; lake or river shores	All	√		√		√	√	√	√							
MIMIDAE - Mockingbirds, thrashers *Dumetella carolinensis* Gray Catbird S5B	country lane or suburban garden with shrubs patches; woodland edges; hedgerows; forest clearings with brushy areas; near water; territory about 0.3 ha	3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E; 7E	√		√		√	√		√							
MIMIDAE - Mockingbirds, thrashers *Mimus polyglottos* Northern Mockingbird S3S4	pastures, gardens or orchards with edible fruit- bearing shrubs; woodland edges, hedgerows; groves of large trees, low, dense woody vegetation; needs elevated perches	2E; 3E; 3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E					√	√		√							
MIMIDAE - Mockingbirds, thrashers *Toxostoma rufum* Brown Thrasher S5B	open pastures, hedgerows or woodland edges with bushes, low trees or tangles of vines; areas of low, dense woody vegetation; early successional habitat; overgrown hawthorn pasture or marginal farmland	3E; 3W; 3S; 4E; 4W; 4S 5E; 5S; 6E; 7E						√		√							

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands/ Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
BOMBYCILLIDAE - Waxwings *Bombycilla cedrorum* Cedar Waxwing S5B	open, deciduous, coniferous forests; forest edges; orchards, woodlots; residential areas with shade trees; semi-open country; agricultural areas; near water, with available supply of berries; edges of ponds, lakes, rivers, marshes, fens, open swamps	All	√		√		√	√		√							
PARULIDAE - Wood warblers *Vermivora pinus* Blue-winged Warbler S4B	brushy, overgrown fields or meadows or old fields with saplings >3 m tall; second growth woodlands, edges; borders of wooded swamps, willow swamps, stream-sides; woodland openings; requires >20 ha of habitat	5E(7,8); 6E(1,2,3,4,5,6,7,8,9,10); 7E	√					√		√							
PARULIDAE - Wood warblers *Vermivora chrysoptera* Golden-winged Warbler S4B	early successional habitat; shrubby, grassy abandoned fields with small deciduous trees bordered by low woodland and wooded swamps; alder bogs; deciduous, damp woods; shrubbery clearings in deciduous woods with saplings and grasses; brier-woodland edges; requires >10 ha of habitat	4E; 5E; 5S; 6E; 7E	√					√		√							
PARULIDAE - Wood warblers *Vermivora peregrina* Tennessee Warbler S5B	brushy, semi-open land; grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees; treed fens or boggy areas; dry pine plantations and beach ridges	All except 7E	√		√			√		√							
PARULIDAE - Wood warblers *Vermivora celata* Orange-crowned Warbler S4B	open deciduous or mixed woods with shrub undergrowth; second growth in clearings or burns; brushy thickets and tall stands of shrubbery	1E; 2E; 2W;3E; 3W; 3S; 4S; 5S						√		√							
PARULIDAE - Wood warblers *Vermivora ruficapilla* Nashville Warbler S5B	wet, open coniferous, deciduous or mixed woods of young secondary growth; cedar, spruce swamps; dry or moist overgrown pastures and old field with scattered trees and shrubs; edges; nests in depressions in ground under dead, dry bracken fern	All	√					√		√							
PARULIDAE - Wood warblers *Parula americana* Northern Parula S4B	wooded bogs or swamps; conifers on which bearded lichen grows; closed canopy coniferous or mixed woods near water; area sensitive requiring at least 100 ha; an interior forest species	All except 1E	√						√	√							√
PARULIDAE - Wood warblers *Dendroica petechia* Yellow Warbler S5B	open areas with dense scrub; shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery; farmlands, orchards or suburban yards	All	√		√	√	√	√									
PARULIDAE - Wood warblers *Dendroica pensylvanica* Chestnut-sided Warbler S5B	shrubby, second growth deciduous woodland edges and fields next to stands of mature forest; hardwood regeneration stands; brushy watercourses; woodland clearings, burns; brushy woodland margins	All						√		√							
PARULIDAE - Wood warblers *Dendroica magnolia* Magnolia Warbler S5B	mainly mixed and coniferous forests; may be mature trees but require dense shrubs; in mature forests, prefer open areas, edges; disturbed woodland; appears to require about 30 ha in the south	All except 7E(1)	√					√	√	√							√
PARULIDAE - Wood warblers *Dendroica tigrina* Cape May Warbler S5B	a boreal forest species; coniferous and mixed forests; prefer relatively open woods and edges, but also occupy dense forest; require tall, mature coniferous trees	2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S							√	√							
PARULIDAE - Wood warblers *Dendroica caerulescens* Black-throated Blue Warbler S5B	an interior forest species; deciduous or mixed second growth forest; requires relatively closed canopy, but shrub undergrowth; hemlocks preferred in mixed forests; nests close to ground; likely requires over 100 ha in locations off the Shield	3E;3W;3S;4E; 4W; 4S; 5E; 6E(2,3,4,5,6,7,8,9,10,11,12,14)	√					√	√	√	√						√
PARULIDAE - Wood warblers *Dendroica coronata* Yellow-rumped Warbler S5B	dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar; with scattered openings from logging, fire or abandoned fields; evergreen plantations; young coniferous growth at woodland edges; also wetter habitat of black spruce or tamarack; adaptable and opportunistic	All except 7E(1,3,5)	√					√	√	√							
PARULIDAE - Wood warblers *Dendroica virens* Black-throated Green Warbler S5B	prefer dense, mixed forest, but also coniferous or more open woods; hemlock, fir are favoured conifers; wet cedar swamps; beech, maple, birches with multi-layered canopy and well developed shrub layer; requires about 30 ha	All except 1E	√						√	√							√
PARULIDAE - Wood warblers *Dendroica fusca* Blackburnian Warbler S5B	an interior forest species; requires mature deciduous or mixed forest; swampy woods with spruces thickly draped with bearded lichen; second growth deciduous woods; hardwood forests with chestnut trees; requires about 50 ha	All except 1E	√						√	√							√
PARULIDAE - Wood warblers *Dendroica pinus* Pine Warbler S5B	mature white pine (red to lesser degree) forests that are somewhat open; 40 to 50 year old pine plantations; area sensitive needing at least 15-30 ha	4E; 4W; 4S; 5E; 5S; 6E; 7E							√								√
PARULIDAE - Wood warblers *Dendroica discolor*[illegible] Prairie Warbler S3B	scrub-land; mixed pine-oak barrens; old pastures; hillsides with scattered red cedars; avoids thick woods and benefits from cutting and burning of forests	5E(7,11); 6E(1,6,7,9,10); 7E(2)				√		√		√						√	
PARULIDAE - Wood warblers *Dendroica palmarum* Palm Warbler S5B	in summer, bogs; during migration, open places, especially weedy fields and borders of marshes and woodlands; nests on ground in grass clump; territories are 1-2 ha in size; less common in south, particularly where wetlands have been eliminated	All but 7E	√							√							
PARULIDAE - Wood warblers *Dendroica castanea* Bay-breasted Warbler S5B	mature, conifer or mixed forest with spruce, balsam fir; young trees along ponds or streams or in bogs or forest clearings; early coniferous second growth	All except 6E; 7E	√		√			√	√								
PARULIDAE - Wood warblers *Dendroica cerulea*[illegible] Cerulean Warbler S3B	mature deciduous woodland of Great Lakes- St. Lawrence and Carolinian forests, sometimes coniferous; swamps or bottomlands with large trees; area sensitive species needing extensive areas of forest (>100 ha)	5E(7,8,9); 6E(1,2,3,4,5,6,7,10,11, 14); 7E							√							√	√
PARULIDAE - Wood warblers *Mniotilta varia* Black-and-white Warbler S5B	breeds at edges of large continuous stands of mature or old second growth deciduous or mixed forest; cedar swamps or bogs; riparian habitat; during migration prefer bottomland forests and forest edges; nests in interior in the south; area sensitive, requiring in excess of 100 ha of continuous forest	All	√		√			√	√	√	√						√

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands/ Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Snags	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
PARULIDAE - Wood warblers *Setophaga ruticilla* American Redstart S5B	deciduous or mixed woods with closed canopy of either tall shrubs or dense young trees or mature trees; woodland edges; upland or lowland; requires >100 ha of forest habitat	All except 1E	√					√		√							√
PARULIDAE - Wood warblers *Protonotaria citrea*[E] Prothonotary Warbler S1S2B	area sensitive species preferring 100 ha of flooded or swampy woodlands with standing or flowing water and more than 25% canopy cover with numerous stumps and snags; stream borders or flooded bottomlands; soft, dead trees with dbh >10 cm; Carolinian species	6E(1,2,3); 7E(1,2,5)	√												√	√	√
PARULIDAE - Wood warblers *Seiurus aurocapillus* Ovenbird S5B	undisturbed, open, mature deciduous or mixed forest with closed canopy, little ground vegetation, lots of fallen leaves, logs or rocks; forested ravines or well-drained riverbanks; nests in depression of dead leaves at base of tree or log; area sensitive species, requiring >70 ha of continuous forest	All			√				√		√		√				√
PARULIDAE - Wood warblers *Seiurus noveboracensis* Northern Waterthrush S5B	cool, shady, wet ground with open shallow pools of water; shrubby tangles, fallen logs; wooded swamps, bogs, creek, stream banks or swampy lakeshores; nests in banks, upturned tree roots or under mossy logs or stumps	All	√		√				√		√						
PARULIDAE - Wood warblers *Seiurus motacilla*[V(COSEWIC; COSSARO)] Louisiana Waterthrush S3B	prefers wooded ravines with running streams; also woodlands swamps; large tracts of mature deciduous or mixed forests; canopy cover is essential; has strong affinity to nest sites; nests on ground	5E(11);6E(1,2,5,8,9,10, 11); 7E	√	√					√		√					√	
PARULIDAE - Wood warblers *Oporornis agilis* Connecticut Warbler S4B	well-spaced black spruce swamps with good ground cover of Labrador Tea; moist woodlands with well-developed understory for nesting; aspen or poplar	2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E(1,2,3,4); 5S	√					√			√						
PARULIDAE - Wood warblers *Oporornis philadelphia* Mourning Warbler S5B	shrubby, forest clearings; burned or over-cut areas with saplings and brambles; dense underbrush; margin of lowland swamps, bogs, watercourses; mesic areas with dense shrubby undergrowth; extensive stands of dense saplings; woodland edges	All except 1E	√					√		√	√						
PARULIDAE - Wood warblers *Geothlypis trichas* Common Yellowthroat S5B	wetlands; cattail marshes, bogs; dense shrubby thickets on stream, pond margins; woodland edges; dense tangles near water; dense undergrowth in open woods; second growth old fields; feeds on or near ground	All	√		√			√		√	√						
PARULIDAE - Wood warblers *Wilsonia citrina*[T(COSEWIC)] Hooded Warbler S3B	favours mature, deciduous forest (Carolinian), particularly along stream bottoms, ravine edges and where saplings and shrubbery grow; nests above ground in small shrubs; feeds on or near ground	7E		√					√		√		√			√	
PARULIDAE - Wood warblers *Wilsonia pusilla* Wilson's Warbler S5B	boggy areas with cedar, tamarack or spruce; swampy, brushy land; streamside thickets and tangles; wet, wooded high shrubs or low deciduous trees	All except 6E; 7E	√		√			√			√						
PARULIDAE - Wood warblers *Wilsonia canadensis* Canada Warbler S5B	an interior forest species; dense, mixed coniferous, deciduous forests with closed canopy, wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat; usually requires at least 30 ha	All except 1E	√						√		√						√
PARULIDAE - Wood warblers *Icteria virens*[V,V] Yellow-breasted Chat S2S3B	thickets, tall tangles of shrubbery beside streams, ponds; overgrown bushy clearings with deciduous thickets; nests above ground in bush, vines etc.	6E(1,5,9,10,15); 7E			√			√		√						√	
THRAUPIDAE -Tanagers *Piranga olivacea* Scarlet Tanager S5B	upland, undisturbed, mature deciduous or mixed forests in Carolinian and Great Lakes-St. Lawrence Forest zones; nests in thick growth of small trees bordering forests of larger trees; also damp, alder, willow thickets; requires at least 20 ha of forest	All except 1E; 2W	√					√	√								√
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Pipilo erythrophthalmus* Eastern Towhee S4B	dense, brushy cover with leaf litter; abandoned fields or pastures with developing young trees or shrubs; woodland edges with dense undergrowth; streamside thickets; brushy hillsides	4E; 5E; 5S; 6E; 7E						√		√	√						
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Spizella arborea* American Tree Sparrow S5B	open areas with scattered trees, brush; low-lying tundra with stands of shrubs, stunted trees, especially willow, birch, alder; in winter, weedy, brushy fields; open country with groves of small trees; hedgerows; marshes	1E (summer); 5E; 6E; 7E (winter)	√					√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Spizella passerina* Chipping Sparrow S5B	open, grassy areas next to woodland or with thickets of trees; lawns, gardens or orchards; open mixed woodland; forest clearings; lakeshores or stream borders	All					√	√	√	√	√						
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Spizella pallida* Clay-coloured Sparrow S4B	brushy, open areas in prairies; young pine plantations; abandoned fields with shrubs, small trees; regenerating burns; thickets along edges of waterways	All			√	√		√									
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Spizella pusilla* Field Sparrow S5B	open areas with low shrubs or trees; abandoned pasture, farm fields; overgrown power line corridors; thickets; forest edges; young conifer plantations	5E; 6E; 7E				√		√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Pooecetes gramineus* Vesper Sparrow S5B	open areas with short, herbaceous vegetation and song perches; fields with hedgerows or regrowth; well-drained dry grassland areas with scattered trees or shrubs; open, dry conifer plantations; gravel pits; short grass meadows and pastures	All except 1E; 2E; 2W				√											
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Passerculus sandwichensis* Savannah Sparrow S5B	hayfields, pastures, fields and meadows with dense ground vegetation of grasses and other vegetation of moderate height; moist lowlands and sedge meadows bordered by willows and sweet gale; territory is 1.5 to 2 ha in size; requires tracts of grassland >50 ha	All	√		√	√											√

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands / Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Colonial	Cavity Nester	Provincially Rare	Area Sensitive
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Ammodramus savannarum* Grasshopper Sparrow S4B	well-drained grassland or prairie with low cover of grasses, taller weeds on sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities; perches for singing; requires tracts of grassland > 10 ha	4E; 5E; 5S; 6E; 7E				√											√
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Ammodramus henslowii* [illegible] Henslow's Sparrow S1B (protected in Regulation under *Endangered Species Act*)	large, fallow, grassy area with ground mat of dead vegetation, dense herbaceous vegetation, ground litter and some song perches; neglected weedy fields; wet meadows; cultivated uplands; a moderate amount of moisture needed; requires a minimum tract of grassland of 40 ha, but usually in areas >100 ha	5E(1,2,3,7,8,9,11); 6E; 7E(2)				√										√	√
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Ammodramus leconteii* Le Conte's Sparrow S4B	nest in variety of open habitats; often found on drier edges of marshes and wet meadows in grasses, sedges, alder, willow; dense graminoid marsh, with or without shrubs	1E; 2E; 2W; 3E; 3W; 4E; 4W; 4S; 5S; 6E(1,5)	√			√											
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Melospiza melodia* Song Sparrow S5B	brushy edge habitat near water; swamps, brushy clearings, pastures or fields; hedgerows; ponds or stream shores; elevated perches for song-posts	All	√		√	√	√	√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Melospiza lincolnii* Lincoln's Sparrow S5B	muskegs, bogs, swamps; regenerated stands following cutting or fires; hedgerows; spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge; edges of lakes, rivers	All except 7E(1,2,3,4,6)	√		√			√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Melospiza georgiana* Swamp Sparrow S5B	wetlands with little overstory; extensive cattail marshes, wet meadows, bogs of grasses, sedges or reeds; low swampy shores of lakes and streambanks; deciduous riparian thickets; moist woodlands	All	√		√			√									
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Zonotrichia albicollis* White-throated Sparrow S5B	coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, white birch; old cut-overs or burns with forest regeneration and slash piles; brushy clearings; borders of bogs; nests on ground in brush piles or under log	All	√					√		√	√						
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Zonotrichia leucophrys* White-crowned Sparrow S4B	breeding habitat is shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, stream edges; nests on ground; may winter in southern Ontario	1E; 2E; 2W			√			√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Junco hyemalis* Dark-eyed Junco S5B	coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas; forest edges; borders of streams or clearings; nests in depression on ground, under roots, rocks or logs; winters in conifers, hedgerows or brushy field borders	All						√		√	√						
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Cardinalis cardinalis* Northern Cardinal S5	open woodlands with heavy underbrush; woodland edges; urban areas, parks, groves, gardens; swamps or streamside thickets; brushy tangles; nests in dense shrub, small trees, tangles of vines, thickets or briars	4E; 5E; 6E; 7E	√				√	√		√	√						
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Pheucticus ludovicianus* Rose-breasted Grosbeak S5B	immature and mature broad-leaved deciduous forests; swamp borders; thickets, old orchards; suburban trees, shrubs	All except 1E; 2E; 2W; 7E(1)	√				√	√	√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Passerina cyanea* Indigo Bunting S5B	deciduous, mixed forest; woodland edge or hedgerows; second-growth shrubbery; old fields; old burns; thickets; brushy ravines; vegetated areas along creeks, rivers; needs elevated perches	All except 1E	√		√			√		√							
ICTERIDAE - Meadowlarks, blackbirds, orioles *Dolichonyx oryzivorus* Bobolink S4B	large, open expensive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha	All except 1E; 2W	√			√											√
ICTERIDAE - Meadowlarks, blackbirds, orioles *Agelaius phoeniceus* Red-winged Blackbird S5B	marshes, swamps, ponds or wet meadows with extensive growth of cattails, bulrushes, sedges or reeds; grassy roadsides, suburban gardens or dry fields; colonial nester	All	√	√	√	√	√							√			
ICTERIDAE - Meadowlarks, blackbirds, orioles *Sturnella magna* Eastern Meadowlark S5B	open, grassy meadows, farmland, pastures, hayfields or grasslands with elevated singing perches; cultivated land and weedy areas with trees; old orchards with adjacent, open grassy areas >10 ha in size	3E; 4E; 5E; 5S; 6E; 7E				√											√
ICTERIDAE - Meadowlarks, blackbirds, orioles *Sturnella neglecta* Western Meadowlark S4B	prairies, grasslands >10 ha in size	6E(1,2,3,4,5,6,7,8,9,14)				√											√
ICTERIDAE - Meadowlarks, blackbirds, orioles *Xanthocephalus xanthocephalus* Yellow-headed Blackbird S3	deep (0.6 to 1.2 m) marshes or sloughs, lake edges with emergent vegetation, cattails, reedy lakes; also forages on grain fields, freshly ploughed ground and barnyards; nests in semi-colonial situations	3S; 4S; 5S; 6E(4,6); 7E(1,2)	√											(√)		√	
ICTERIDAE - Meadowlarks, blackbirds, orioles *Euphagus carolinus* Rusty Blackbird S5B	openings in coniferous woodlands bordering bodies of water; tree- bordered marshes, beaver ponds, muskegs, bogs, fens or wooded swamps; stream borders with alder, willow; wooded islands on lakes	All except 7E	√	√	√	√		√		√							

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands,/ Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Colonial**	**Cavity Nester**	**Provincially Rare**	**Area Sensitive**
ICTERIDAE - Meadowlarks, blackbirds, orioles *Euphagus cyanocephalus* Brewer's Blackbird S4	grassy prairie with trees or shrubs, marsh edges, bogs, dry open fields, roadside ditches with fresh water; forages extensively in fields, pastures (often associated with cattle or sheep); golf courses and lawns; nest in colonies of 5 to 10 pairs; new colonies may only have 2 to 3 pairs; have common feeding areas	3E; 3S; 3W; 5E (1,2,3,4,5,6,7); 6E(2,3,4,5,6,8,14); 7E(1)	√			√	√	√						√			
ICTERIDAE - Meadowlarks, blackbirds, orioles *Quiscalus quiscula* Common Grackle S5B	farmland, suburbs or abandoned buildings; meadows; marshes, swamps; coniferous trees, hedges; tree stumps; may nest in small colonies	All except 1E	√		√	√	√	√		√				√			
ICTERIDAE - Meadowlarks, blackbirds, orioles *Molothrus ater* Brown-headed Cowbird S5B	agricultural or residential areas; open coniferous, deciduous woodlands; forest edges; short-grass areas	All except 1E	√		√	√	√	√	√	√							
ICTERIDAE - Meadowlarks, blackbirds, orioles *Icterus galbula* Baltimore Oriole S5B	deciduous, wooded areas with natural openings; hedgerows, deciduous groves, orchards, shade trees in parks, gardens, backyards; woodland edges; along streams and lakes	3E; 3W; 3S; 4E; 4W; 4S; 5E; TS5S; 6E; 7E	√		√		√	√	√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Pinicola enucleator* Pine Grosbeak S4B	open coniferous forests with spruce or fir; forest edges, clearings	1E; 2E; 2W; 3E; 3W; 4E; 4W	√					√	√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Carpodacus purpureus* Purple Finch S5B	coniferous woodland or forest edges; coniferous plantations; ornamental conifers in residential areas, parks; orchards; winters in deciduous woodlands	All					√		√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Loxia curvirostra* Red Crossbill S5B	coniferous forest with red or white pine in Great Lakes-St. Lawrence and southern Boreal Forest zones	3E; 3W; 4E; 4W; 4S; 5E; 5S; 6E; 7E(2,4,5)	√						√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Loxia leucoptera* White-winged Crossbill S5B	boreal forest with tamarack, spruce, fir or hemlock	All except 7E	√						√	√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Carduelis flammea* Common Redpoll S4B	low shrub tundra or barren-lands with patches of spruce, tamarack, alder, willow thickets; winters near alder, birches in snow-covered weedy fields - frequents feeder	1E; 2E; 2W; winters in 6E	√			√		√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Carduelis pinus* Pine Siskin S5B	coniferous, mixed woods; coniferous plantations; alder thickets, weed patches next to forests	All					√	√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Carduelis tristis* American Goldfinch S5B	forest edges; open weedy fields or pastures with scattered trees or woody growth; river bottomlands with serviceberry and hawthorns; immature maples; garden plants in suburbs; open swamps	All except 1E; 2W	√		√		√	√		√							
FRINGILLIDAE - Grosbeaks, finches, sparrows, buntings *Coccothraustes vespertinus* Evening Grosbeak S5B	coniferous or mixed forests; deciduous tree stands; parks, orchards	All except 1E; 7E					√	√	√								

Table G- 4: Habitat descriptions for native Ontario mammals[1].

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swamps	Open Water (Lakes, Ponds, Rivers, Streams)	Riparian - Shores or Nearshore Areas	Grasslands	Parklands,/ Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Seasonally Concentrated	Cavity User	Provincially Rare	Area Sensitive
DIDELPHIMORPHIA *Didelphis virginiana* Virginia Opossum S4	lowland to upland deciduous wooded areas, preferably near water; common on farmland, particularly corn fields; inactive in dens during cold periods; requires live, hollow trees > 60 cm dbh; cold weather limits range; home range 6-16 ha, but may overlap with other opossum; omnivorous but prefers insects, carrion	6E(1,2,4,5,6,14,15); 7E	√		√			√	√	√	√				√		
INSECTIVORA *Sorex arcticus* Arctic Shrew S5	boreal forest, north to tundra; wet meadow, shrub swamp bogs; semi-open low conifer woodlands with closed canopy; relies on leaf litter, downed woody debris for nesting and feeding; feed on insects	1E; 2E; 2W; 3E; 3W; 4E; 4W; 4S; 5S	√						√		√						
INSECTAVORA *Sorex cinereus* Masked Shrew S5	damp deciduous, coniferous forests with cover such as grass, rocks, logs, stumps; bogs, marshes with cover; home range 0.04 ha; relies on grass, downed woody debris, brush for nesting, feeding; feed on insects	All	√					√	√	√	√						
INSECTAVORA *Sorex fumeus* Smoky Shrew S5	moist, upland forests, usually of beech, maple, birch or hemlock with boulders, thick leaf litter; near streams with moss-covered banks; relies on downed woody debris, leaf litter for nesting and feeding	3E; 3W; 4E; 5E; 6E;7E(2,3,4,5,6)	√		√			√	√	√	√						
INSECTAVORA *Sorex hoyi* Pygmy Shrew S4	usually dry woodland, grass clearings, thickets and under ferns; also moist sphagnum areas, damp leaf litter, rotten stumps, logs; relies on downed woody debris, leaf litter for nesting and feeding; prefers insects for food	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 6E(6,7,8,10,11,12); 7E(2,4)	√		√			√	√	√	√						
INSECTIVORA *Sorex palustris* Water Shrew S5	shrubby banks of streams, ponds or other aquatic systems in coniferous forests, sedge marshes; home range 0.3 ha; uses crevices between rocks, tree roots or overhanging banks for cover, nesting, feeding; prefers insects for food	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 6E; 7E(4)	√		√			√	√	√	√						
INSECTIVORA *Blarina brevicauda* Northern Short-tailed Shrew S5	deciduous, mixed, occasionally coniferous forests; open habitat with tall grass or brush piles; along stream banks; grass-sedge marshes; areas of loose, moist humus, low vegetation; home range 0.5 ha; relies on downed woody debris for cover, nesting, feeding; prefers insects for food	All except 1E; 2E	√		√	√	√	√	√	√	√						
INSECTIVORA *Cryptotis parva* Least Shrew SH	open, grassy areas with or without scattered brush; woodland edges; needs loose soil for tunnelling; somewhat gregarious and colonist; feeds on insects, worms; may cache insects for future use	7E(2)			√	√		√	√	√				√		√	
INSECTIVORA *Parascalops breweri* Hairy-tailed Mole S4	open woods or meadows; requires vegetative cover and sufficiently deep soil, loose, moist, well-drained soil; home range 0.1 ha; feeds on worms, adult and larval insects	5E; 6E(1,3,6,7,8,9,10); 7E(2,3,4,5,6)				√		√	√	√							
INSECTIVORA *Scalopus aquaticus*$^{V(COSEWIC)}$ Eastern Mole S2	prefers areas of deep, sandy or sandy-loam soils in pastures, meadows or lawns; occasionally open woodland; often found in moist bottomlands	7E(1)	√			√	√			√						√	
INSECTIVORA *Condylura cristata* Star-nosed Mole S5	low, wet ground such as marshes, wet fields; low-lying woods, shorelines; likes wet, mucky humus; home range 0.4 ha; relies on downed woody debris for cover and feeding; prefers insects	All except 1E	√		√	√	√	√	√	√	√						
CHIROPTERA *Myotis leibii* Small-footed Bat S2S3	roosts in caves, mine shafts, crevices or buildings that are in or near woodland; hibernates in cold dry caves or mines; maternity colonies in caves or buildings; hunts in forests	4E; 5E(34,7,8,9,10,11); 6E;7E(2,3,4,5,6)	√	√	√			√	√	√			√	√	√	√	
CHIROPTERA *Myotis lucifugus* Little Brown Bat S5	uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges	All except 1E	√	√	√		√	√	√	√				√	√		
CHIROPTERA *Myotis septentrionalis* Northern Long-eared Bat S3?	hibernates during winter in mines or caves; during summer males roost alone and females form maternity colonies of up to 60 adults; roosts in houses, manmade structures but prefers hollow trees or under loose bark; hunts within forests, below canopy	All except 1E; 7E(1)							√	√			√	√	√	√	
CHIROPTERA *Lasionycteris noctivagans* Silver-haired Bat S4B	prefers temperate, hardwoods with ponds or streams nearby; roosts in tree foliage or hollow snags, buildings or caves; somewhat solitary except for small maternity colonies usually found in hollow trees; found in forested areas near watercourses; migrates south in winter	2E; 3W; 4E; 4W; 4S; 5E(7,8,9,10,11); 6E; 7E	√	√	√				√	√				√	√		
CHIROPTERA *Pipistrellus subflavus* Eastern Pipistrelle S3?	open woods near water; roosts in trees, cliff crevices, buildings or caves; hibernates in damp, draft-free, warm caves, mines or rock crevices	4E; 5E(8,9,10,11); 6E(1,8,9); 7E(2,3,4)	√	√	√				√	√			√		√	√	
CHIROPTERA *Eptesicus fuscus* Big Brown Bat S5	prefers deciduous forest but thrives in urban and rural settings; roosts in buildings, caves, tunnels or hollow trees; may roost in small colonies; maternity colonies found in buildings; hibernates in cool dry caves or buildings; preferred feeding habitat is over wetlands; found in semi-open forests, agricultural or urban areas	All except 1E; 2E; 2W	√	√	√	√	√	√	√	√				√	√		
CHIROPTERA *Lasiurus borealis* Red Bat S4B	roosts in leafy trees such as elm and maple but also may use conifers; forage habitat includes over streams, near lights and along field and forest edges; migrates south in winter; prefers to feed over wetlands or open fields; a solitary species	2E; 2W; 4E; 4W; 5E(7); 5S; 6E; 7E	√	√	√	√	√	√	√	√							
CHIROPTERA *Lasiuris cinereus* Hoary Bat S4B	roosts in trees with dense leaf foliage, forest edges or hedgerows; also in city parks; do not use caves ; feeds over water or open areas; migrates south in winter; a solitary species, only forming groups while hunting	2E; 3W; 4E; 4W; 5E(2,5,7,8,9,10,11); 5S; 6E; 7E	√	√	√	√	√	√	√	√							
CHIROPTERA *Nycticeius humeralis* Evening Bat SAN	prefers woodland, mixed woodland habitats and watercourses; rarely found in caves; roost and maternity sites in hollow trees or under loose bark	7E(1)		√	√				√	√				√	√		

Family Name Scientific Name Common Name NHIC Ranking (Special Protection Measures)	Habitat / Habits Description	Site Region (Districts)	Wetlands e.g. Marshes, Swa ps	Open Water (Lakes, Ponds, R ivers, Streams)	Riparian - Shores or Nearsho re Areas	Grasslands	Parklands/ Suburban Areas	Thickets, Second Growth	Old Growth, Mature Stands	Forest Edges	Downed Woody Debris	Seeps	Cliffs, Talus Slopes, Ravines	Seasonally Concentrated	Cavity User	Provincially Rare	Area Sensitive
LAGOMORPHA *Sylvilagus floridanus* Eastern Cottontail S5	wooded areas with undergrowth; builds nest in thickets or briars; feeds in grassy areas	5E; 6E; 7E	√			√	√	√		√	√						
LAGOMORPHA *Lepus americanus* Snowshoe Hare S5	primarily resident of boreal forest, but in southern part of range found in cedar and spruce swamps; woods with dense brushy under-story; shrubby old fields or pasture; cut-over areas or burns with forest regeneration	All except 7E(1,2)	√			√		√	√	√	√						
LAGOMORPHA *Lepus arcticus* Arctic Hare SAN	wind-swept rocky slopes; upland tundra; may venture into wooded areas near forest edges	1E				√											
LAGOMORPHA *Lepus townsendii* White-tailed Jackrabbit SH	open areas such as prairies, fields or open agricultural land	5S				√										√	
RODENTIA *Tamias minimus* Least Chipmunk S5	young or mature deciduous, coniferous or mixed forest with openings of shrub and saplings	All except 1E; 6E; 7E			√			√	√	√	√				√		
RODENTIA *Tamias striatus* Eastern Chipmunk S5	deciduous hardwood forests, prefers mature maple-beech woods; open situations; evergreen-deciduous forest edges; needs tree or shrub cover, old logs or stone walls and elevated perches	All except 1E; 2W			√		√	√	√	√	√				√		
RODENTIA *Marmota monax* Woodchuck (Ground Hog) S5	uses wide variety of habitats; favours agricultural areas, small woodlots, open forests or large dense forests; digs deep borrows in ground or under tree roots	All				√	√	√	√	√					√		
RODENTIA *Spermophilus franklinii* Franklin's Ground Squirrel S2S3	prairies or forest clearings, open fields, shrub-sapling opening; open mature mixed, coniferous or deciduous forest	5S				√		√	√	√					√	√	
RODENTIA *Sciurus carolinensis* Gray Squirrel S5	deciduous or mixed forest or woodlots, preferably with mast producing trees; city parks; river bottomland; makes food caches	All except 1E; 2E; 2W			√		√	√	√	√	√				√		
RODENTIA *Tamiasciurus hudsonicus* Red Squirrel S5	all forest types; rural woodlots; makes food caches	All	√		√			√	√	√	√				√		
RODENTIA *Glaucomys sabrinus* Northern Flying Squirrel S5	mature coniferous-deciduous forest, sometimes pure deciduous forest; cool heavily wooded areas; an area sensitive species, it requires 51-100 ha of continuous wooded area	All except 1E; 7E(1,2)	√		√				√	√	√				√		√
RODENTIA *Glaucomys volans*[illegible] Southern Flying Squirrel S3	mature deciduous and mixed forest, particularly beech-maple, oak-hickory and aspen woodlands; needs cavity trees	5E(7,8,9,10,11,12); 6E; 7E							√	√	√				√	√	√
RODENTIA *Castor canadensis* Beaver S5	wetlands with an adequate food supply and deep water; slow flowing brooks, streams, rivers, lakes bordered by woodlands; makes food caches	All	√	√	√			√		√	√						
RODENTIA *Peromyscus leucopus* White-footed Mouse S5	interiors or edges of coniferous, deciduous or mixed forest; brushy woodland clearings or pastures; streamside thickets; nests in cavities, buildings or under stumps and logs; home range 0.2 ha; makes food caches	6E; 7E	√		√	√	√	√	√	√	√				√		
RODENTIA *Peromyscus maniculatus* Deer Mouse S5	wide range of habitat types; interior or edges of coniferous or mixed forest; field borders; out-buildings near areas with small trees and dense ground cover; nests in stone walls, buildings, old burrows, under logs or in tree cavities; home range 1.2 ha	All	√		√	√	√	√	√	√	√				√		
RODENTIA *Clethrionomys gapperi* Southern Red-backed Vole S5	cool, damp or swampy deciduous and coniferous forest with deep litter; among mossy rocks, logs, stumps or other cover; talus slopes;. requires a water source such as a spring or bog and debris cover	All except 7E	√		√					√	√	√	√				
RODENTIA *Phenacomys intermedius* Heather Vole S4	semi-open coniferous forest with understory of heaths; usually near water; bogs	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W;; 4S; 5E(4,5,7)	√			√		√	√	√	√						
RODENTIA *Microtus chrotorrhinus* Rock Vole S3	rocky areas such as moss-covered rock outcrops or talus slopes near streams; cool damp coniferous or mixed forests	2E; 3E; 3W; 4E; 4W; 5E(4,5,9)	√		√				√	√			√			√	
RODENTIA *Microtus pennsylvanicus* Meadow Vole S5	areas with herbaceous vegetation and loose organic soil; wet or dry open areas such as meadows, fields, pastures, swamps, bogs and marshes, open forest, clear-cuts or orchards	All	√		√	√					√						
RODENTIA *Pitymys pinetorum* Woodland Vole S3?	mature deciduous forest in the Carolinian forest zone, with loose sandy soil and deep humus; grasslands, meadows and orchards with groundcover of duff or grass	7E(2,3,5,6)				√		√	√	√	√					√	
RODENTIA *Odonatra zibethicus* Muskrat S5	wetlands with dense emergent vegetation where water doesn't freeze to bottom; shallow portions of lakes or ponds, slow flowing streams and rivers with abundant vegetation; drainage ditches; requires stable water levels; makes food caches	All	√	√	√												
RODENTIA *Synaptomys borealis* Northern Bog Lemming SU	sphagnum bogs, moist black spruce-horsetail forest; dry black spruce-lichen woodland; hemlock-beech forest; sub-alpine meadows, alpine tundra, weedy fields	1E; 2E; 5S	√			√		√	√	√	√					√	
RODENTIA *Synaptomys cooperi* Southern Bog Lemming S4	sphagnum bogs and marshes; moist deciduous or mixed forest with loose duff; well-drained upland covered with grass or forests; orchards; open meadows or small forest openings with sufficient cover; needs moist soils; home range 0.4 ha	1E; 2E; 2W; 3E; 3W; 4E; 4W; 4S; 5E; 6E(1,6,7,14); 7E(2,3,6)	√			√		√	√	√	√						

Family Name **Scientific Name** **Common Name** **NHIC Ranking** **(Special Protection Measures)**	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands / Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Seasonally Concentrated**	**Cavity User**	**Provincially Rare**	**Area Sensitive**
RODENTIA *Zapus hudsonius* Meadow Jumping Mouse S5	forested or open areas with shrubs and small trees; loose soil and herbaceous ground cover; open grassy or brushy marshes, swamps and wet meadows; riparian habitat	All	√		√	√		√		√	√						
RODENTIA *Napaeozapus insignis* Woodland Jumping Mouse S5	cool, moist or dry deciduous and coniferous forested areas with herbaceous ground cover; loose soil and low woody shrubs; brush on along lakes or streams	All except 1E; 2W; 3S; 7E(1)	√		√			√	√	√	√						
RODENTIA *Erithizon dorsatum* Porcupine S5	wooded riparian areas and swamps; orchards, savannahs, old field or pasture; home range 15 ha; den sites in rock ledges, trees or other protected places	All except 7E(1)	√					√	√	√			√		√		
CARNIVORA *Canis latrans* Coyote S5	open woodland or forest edges or openings created by clear-cutting or fires; agricultural areas or open fields; secluded den sites; home range 70 km²; during winter in northern part of range, may concentrate in low-lying areas with lots of prey; makes food caches	All except 1E; 2W	√		√		√	√	√	√	√				√		
CARNIVORA *Canis lupus* Gray Wolf S4	heavily forested areas; home range 300 km²; makes food caches	All except 6E(1,2,3,4,5,6,7,9,12,13,14); 7E	√		√			√	√	√	√				√		
CARNIVORA *Vulpes vulpes* Red Fox S5	dry upland, with open areas, patches of cover; swamps, marsh edges, extensive forests, agricultural areas, suburbs; requires loose soil for maternity den sites; does not den up in winter, sleeping open and using downed woody debris for cover; makes food caches	All	√		√	√	√	√	√	√	√				√		
CARNIVORA *Urocyon cinereoargenteus*$^{\text{(COSEWIC)}}$ Gray Fox SZN?	hardwood forests with a mix of fields and woods; swamps; wooded, brushy or rocky habitats; woodland farmland edge; old fields with thickets; dens in hollow log or tree; individual has numerous winter dens throughout its range which is > 40 ha	3W; 4W; 5S; 6E(6,7,8,9,11,12); 7E(2,5)	√			√		√	√	√					√		
CARNIVORA *Ursus americanus* Black Bear S5	large undeveloped tracts of mixed forest with clearings, early successional vegetation, mast trees and thick understory; swamps; dens under fallen trees, in hollow logs, rock ledges, slash piles or other protected areas	All except 7E	√		√			√	√	√	√				√		
CARNIVORA *Procyon lotor* Raccoon S5	wooded areas near lakes or streams, with open fields; wetlands; near human habitation; needs water	All	√	√	√	√	√	√	√	√	√	√			√		
CARNIVORA *Martes americana* Marten S5	continuous tracts of mature coniferous or conifer dominated mixed wood forests; cedar swamps; mainly terrestrial in winter and more arboreal in summer; home range is larger for males (2.0-15.0 km²) than females (0.8-8.4 km²); maternal dens in cavities of trees > 40 cm dbh; also require large snags as summer resting sites; winter den and resting sites under snow cover in large logs, stumps or snags	All except 6E(1,2,3,4,5,6,7,13,14, 15), 7E	√		√			√	√	√	√				√		√
CARNIVORA *Martes pennanti* Fisher S5	requires extensive forest cover; mixed or early-successional deciduous forests; forested wetlands such as wet meadows, swamps and bogs; riparian habitats; mainly terrestrial; home range about 20 km²; nests in hollow trees, log or cavity among rocks; makes food caches	All except 6E(1,2,3,4,5,6,7,8,9,13, 14,15); 7E	√		√			√	√	√	√				√		√
CARNIVORA *Mustela erminea* Ermine (Short-tailed Weasel) S5	wooded or open habitat with heavy cover such as thickets or rock piles; often close to watercourses; home range 25 ha; needs small rodents for food and dense brushy cover; relies on downed woody debris for cover, food and nesting; makes food caches	All except 7E(1)	√		√	√		√		√	√				√		
CARNIVORA *Mustela frenata* Long-tailed Weasel S4	farmland, prairies, woodlands, swamps; forest edges, hedgerows and fencerows; dens in previously excavated burrows or natural holes or crevices	3E; 3W; 4E; 4W; 5E; 6E; 7E	√		√	√		√		√	√				√		
CARNIVORA *Mustela nivalis* Least Weasel SU	grassy, brushy areas; open woodland; river bottoms; marshes; floodplains; dens in stump, log, rabbit hole or rock pile; makes food caches	2W; 3E; 5E(8)	√		√	√		√		√	√				√	√	
CARNIVORA *Mustela vison* Mink S5	stream banks, lakeshores, beaver ponds, marshes or forested wetlands with lots of cover such as rocks, logs or thickets; dens inside hollow logs, under tree roots or in burrows along watercourse edges; makes food caches	All	√	√	√					√	√				√		
CARNIVORA *Taxidea taxus* American Badger S2S3	open grasslands and oak savannahs; dens in new hole or enlarged existing hole; sometimes makes food caches	7E(2,5)				√									√	√	
CARNIVORA *Mephitis mephitis* Striped Skunk S5	semi-open woods, orchards or savannah; meadows, grasslands, fields, cultivated lands or pasture; rural or urban areas; dumps; dens in buildings, stumps, rock cavities, abandoned burrows	All except 2W				√	√			√	√				√		
CARNIVORA *Lontra candensis* River Otter S5	riparian habitat; borders of streams, lakes or other wetlands in forested areas; needs a body of water and suitable den sites such as crevices in rocky ledges, under a fallen tree, an abandoned beaver or muskrat lodge or dense thickets bordering water; home range changes as water freezes or feeding or living conditions are altered	All except 6E(1); 7E	√	√	√						√				√		
CARNIVORA *Felis concolor cougar*$^{\text{(COSEWIC)}}$ Cougar SH (protected in Regulation under *Endangered Species Act*)	undisturbed, mixed, coniferous forests; rough, hilly country; swampy land	undetermined	√					√	√	√						√	

Family Name **Scientific Name** **Common Name** **NHIC Ranking** **(Special Protection Measures)**	**Habitat / Habits Description**	**Site Region (Districts)**	**Wetlands e.g. Marshes, Swamps**	**Open Water (Lakes, Ponds, Rivers, Streams)**	**Riparian - Shores or Nearshore Areas**	**Grasslands**	**Parklands/ Suburban Areas**	**Thickets, Second Growth**	**Old Growth, Mature Stands**	**Forest Edges**	**Downed Woody Debris**	**Seeps**	**Cliffs, Talus Slopes, Ravines**	**Seasonally Concentrated**	**Cavity User**	**Provincially Rare**	**Area Sensitive**
CARNIVORA *Lynx canadensis* Lynx S5	interiors of extensive unbroken coniferous or deciduous forests; distribution strongly tied to distribution and abundance of snowshoe hares; swamps or bogs; rocky areas; uses secluded den sites such as among rocks, under a fallen tree or in a hollow log or other natural cavity; home range 20 km²	All except 7E	√					√	√	√	√				√		√
CARNIVORA *Lynx rufus* Bobcat S3S4?	mixed or deciduous forest; brushy and rocky woodlands broken by fields, old roads and farmland; cedar swamps and spruce thickets; areas with thick undergrowth, conifer cover in winter; dens in log, thicket or under rock ledge; home range 196 km², covering 32-40 km in one night	2E; 3E; 3W; 3S; 4E; 4W; 4S; 5E(11); 6E(11)	√					√	√		√		√		√	(√)	
ARTIODACTYLA *Odocoileus virginianus* White-tailed Deer S5	forest with interspersed open areas such as pastures or fields, forest edges; swamps and swamp edges; in winter requires dense cover such as stands of conifers; in more northern range, yards up in winter	All except 1E; 2E; 2W	√		√	√	√	√	√	√		√		√			
ARTIODACTYLA *Alces alces* Moose S5	Boreal Forest and Great Lakes-St. Lawrence regions; requires some semi-open spaces and swamps or other wetlands for cover and aquatic plants for food; feeding areas with specific aquatic plant species are used; travel corridors to these sites are important; naturally occurring mineral licks are important in spring and early summer; in summer, wetlands preferred; in winter drier forests used; cut-overs and burns particularly important; concentrate in larger numbers at specific sites in winter, during calving and at mineral licks	1E; 2E; 2W; 3E; 3W; 3S; 4E; 4W; 4S; 5E; 5S; 6E(12)	√	√	√			√	√	√		√		√			√
ARTIODACTYLA *Cervus elaphus nelsoni* American Elk (Wapiti) re-introduced (contact MNR for information on the Elk Restoration Plan which began in 1998)	wide variety of habitats; prefers semi-open forests; performs local, seasonal movements; live in herds but calving occurs singly, usually in open country	4E; 5E broad geographic areas offering suitable habitat for elk restoration include: Lake of the Woods, Haliburton Highlands, Lake Huron (north shore), Nipissing-French River, Frontenac Axis, Ottawa Valley	√		√	√		√	√	√				√			
ARTIODACTYLA *Rangifer tarandus*[illegible] Woodland Caribou S3S4?	large expanses (at least 130-150 ha) of mature, lichen-rich coniferous forest (particularly 80-120 year old jack pine); uniformly aged stands; bogs, fens; in winter, wander in small bands of three or four	1E; 2E; 2W; 3E; 3W; 3S; 4W; 4S; 5S	√						√	√				√		√	√

[1] The following species are not listed in this table by virtue of their more northern geographic range: Beluga, *Delphinapterus leucas*; Arctic Fox, *Alopex lagopus*, Polar Bear, *Ursus maritimus*[illegible]; Wolverine, *Gulo gulo*[illegible]; Walrus, *Odobenus rosmarus*; Ringed Seal, *Phoca hispida*; Bearded Seal, *Erignathus barbatus*. European Hare, *Lepus europaeus*, is not listed, as it is not believed to be a native component of Ontario's fauna.

Table G-5. Habitat descriptions for rare vascular plants that are tracked by the Ministry of Natural Resources Natural Heritage Information Centre (NHIC).

Family: Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description**[2]	**Site Region**[3] **(Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
ACANTHACEAE *Justicia americana*[7,11] Water-willow S2	borders of streams, lakes and ponds	7E(1,2,3,5)		√				√							√		
ADOXACEAE *Adoxa moschatellina* Muskroot S1	moist to wet, rich deciduous or coniferous woods	4W,5S														√	
ALISMATACEAE *Alisma gramineum* Narrow-leaved Water-plantain S3S4	shallow water and muddy shores	5E(11);6E(10,11,12,15);7E(4)		√										√			
ALISMATACEAE *Sagittaria graminea var. cristata* Crested Arrow-head S3	shallow, alkaline water of rocky or sandy shores	5E(2,3,7);6E(4,6,8,14); 7E(2)		√										√			
ANACARDIACEAE *Rhus copallina* Winged Sumac S3S4	rocky outcrops and dry sandy areas	5E(11);6E(10);7E(1,2,6)							√								
ANNONACEAE *Asimina triloba* Pawpaw S3	moist woods and stream banks	7E						√								√	√
APIACEAE *Chaerophyllum procumbens var. procumbens* Spreading Chervil S2	rich moist deciduous woods and edges, thickets; moist open places	7E(1,2)														√	
APIACEAE *Chaerophyllum procumbens var. shortii* Spreading Chervil S1	rich moist deciduous woods and edges, thickets; moist open places	7E(1,2)														√	
APIACEAE *Conioselinum chinense* Hemlock Parsley S3	calcareous cedar swamps, wet borders of streams and rivers, seepage slopes in wet coniferous woods, swampy thickets, moist clearings and damp roadsides - in northern Ontario in *Salix-Alnus* thickets; moist *Populus* stands, moist sandy shorelines	2E,6E(1);7E(2)						√			√				√	√	
APIACEAE *Erigenia bulbosa* Harbinger-of-spring S3	rich, moist deciduous woods, open, wooded river floodplains and bottomlands, streambanks and limestone shingle shores	6E(1); 7E(1,2,4,6)						√								√	
APIACEAE *Ligusticum scoticum* Scotch Lovage S3	coastal, intertidal marshes and supratidal meadow-marshes; raised sand, gravel beach ridges; tidal mudflats and moist, clay-gravel shore matrix	2E										√			√		
APIACEAE *Oxypolis rigidior* Stiff Cowbane S2	moist, sandy-clay prairies, rich wet to mesic hardwood forests, sandy, swampy woodlands, thickets and meadows; open, sandy fields	7E(1)					√								√	√	
APIACEAE *Sanicula canadensis var. grandis* Long-styled Canadian Snakeroot S2	rich deciduous woods	7E(2,3,6)														√	
APIACEAE *Thaspium barbinode* Hairy-jointed Meadow-parsnip S1	dry to moist soil of low, sandy woods and clearings, rich wet to mesic hardwoods, openings in *Juniperus* savannahs on limestone flats, thickets and borders of wetlands	7E(1,3,5)								√					√	√	
APIACEAE *Thaspium trifoliatum* Meadow-parsnip S2	clay soil of oak-hickory woods and floodplain forests, thickets and woodland edges and dry upland woods	7E(1)						√								√	√
APIACEAE *Zizia aptera* Heartleaf Alexanders S2	dry open scrubby woods, rocky calcareous riverflats, clearings in cedar-spruce woods and adventive along railway tracks	6E(2);7E(2)						√								√	√
ARACEAE *Arisaema dracontium*[7] Green Dragon S3	wet bottomlands along rivers and creeks	6E(1);7E						√							√	√	
ARACEAE *Peltandra virginica* Arrow-arum S2	shallow waters in streams, rivers and marshes	5E(2,3);6E(8,10,15); 7E(6)	√	√											√		
ARALIACEAE *Oplopanax horridus* Devil's Club S1	open-mixed or coniferous woods and thickets	3W														√	
ARALIACEAE *Panax quinquefolium*[7] Ginseng S3	deep leaf litter in rich, moist deciduous woods, especially on rocky, shaded cool slopes in sweet soil	5E(7);6E;7E														√	
ASCLEPIADACEAE *Asclepias hirtella* Tall Green Milkweed S1	dry sandy soil, prairies	7E(1)					√										
ASCLEPIADACEAE *Asclepias purpurascens* Purple Milkweed S2	dry to moist thickets, prairies, alvar	7E(1)	√				√			√							√
ASCLEPIADACEAE *Asclepias sullivantii* Prairie Milkweed S2	wet meadows and prairies, and adventive along roadsides	7E(1,4)					√										
ASCLEPIADACEAE *Asclepias verticillata* Whorled Milkweed S2	open, sandy woods, and adventive along roadsides and in old fields	6E(1);7E(1,2,3)														√	√

Family, Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
ASCLEPIADACEAE Asclepias viridiflora Green Milkweed S2	open sandy woods and sand dunes, savannah and alvar	5E(3);7E(1,2)	√			√				√						√	
ASCLEPIADACEAE Asclepias ovalifolia Oval Milkweed S1	silty, river banks, prairie	5S					√	√								√	
ASPLENIACEAE Asplenium ruta-muraria Wallrue Spleenwort S2	cliffs and crevices in very dry limestone rock	5E(2);6E(14)			√				√				√				
ASPLENIACEAE Asplenium scolopendrium Hart's-tongue Fern S3	shaded calcareous rock (limestone and dolostone)[3]	6E(4,5)			√				√				√			√	
ASTERACEAE Adenocaulon bicolor Trail-plant S1	wooded rocky hillsides	6E(14)														√	
ASTERACEAE Antennaria microphylla Pussy-toes S1	open, dry to mesic prairies and stream margins	2E					√	√									
ASTERACEAE Antennaria [illegible] Pussy-toes S1?	exposed rocky outcroppings, open woods from lower montane to alpine and arctic zones	2E;3W;4W							√							√	
ASTERACEAE Antennaria parvifolia Pussy-toes S1	open, dry prairies and exposed rocky places	3W;4W					√		√								
ASTERACEAE Antennaria rosea Pussy-toes S1	exposed rocky outcroppings, open woods from lower montane to alpine and arctic zones	2E;3W;4W							√							√	
ASTERACEAE Antennaria subviscosa Pussy-toes S1	exposed rocky outcroppings, open woods from lower montane to alpine and arctic zones	2E;3W;4W							√							√	
ASTERACEAE Arnica cordifolia Heartleaf Arnica S1	mixed woods	3W;4W														√	
ASTERACEAE Arnica lonchophylla ssp. chionopappa Snowy Arnica S1	cold, calcareous sites in open woodlands, river gravels, shorelines, rocky barrens, outcrops and cliff crevices	1E;3W;4W			√							√				√	
ASTERACEAE Arnica lonchophylla ssp. lonchophylla Arnica S1	cold, calcareous sites in open woodlands, river gravels, shorelines, rocky barrens, outcrops and cliff crevices	1E;3W;4W			√							√				√	
ASTERACEAE Artemisia frigida Prairie Sagebrush [illegible]	prairies and dry open places,[3] cliffs and adventive along roadsides	4W, 5S			√		√		√								
ASTERACEAE Artemisia tilesii Tilesius Wormwood S2	raised beaches and ridges along coast	2E										√					
ASTERACEAE Aster alpinus Alpine Aster S1	arctic/alpine tundra	1E												√			
ASTERACEAE Aster brachyactis Rayless Aster S3?	Coastal salt marshes in N. Ont., saline, waste places, roadsides, entirely adventive[3] in southern Ontario	2E										√			√		
ASTERACEAE Aster divaricatus[3] White Wood Aster S1	mesic to dry deciduous woods	7E (3,5)														√	
ASTERACEAE Aster dumosus Bushy Aster S2	wet marshy thickets and wet sandy shores	6E(13,15); 7E (1,2)										√			√		
ASTERACEAE Aster ericoides var. pansus Prairie Heath Aster S1	dry prairie-like grasslands	4S;5S					√										
ASTERACEAE Aster praealtus Willow Aster S2	sandy, prairie-like open oak savannahs	7E(1)					√			√							√
ASTERACEAE Aster prenanthoides Crooked-stem Aster S2	moist woods, fields, floodplain woods	7E(2)						√								√	
ASTERACEAE Aster radula Rough Aster S1	open, grassy fens	2E													√		
ASTERACEAE Aster schreberi Schreber's Aster S2	woods[3]	7E														√	
ASTERACEAE Aster sericeus[3] Silver-leaf Aster S1	open oak woods and glades on sand and limestone soils	5S							√								√
ASTERACEAE Aster shortii Short's Aster S2	mesic to dry deciduous woods and savannah	7E(1)	√							√						√	√
ASTERACEAE Bidens coronata Southern Tickseed S2	moist, sandy meadows, marshes, stream banks and gravelly shores	5E(7); 7E(1,2,5)						√				√			√		

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
ASTERACEAE *Bidens hyperborea* Estuary Beggar-ticks S1S2	shore of James Bay[7]	1E,2E										√			√		
ASTERACEAE *Cacalia plantaginea*[V] Prairie Indian-plantain S3	marl fens, wet meadows, sandy shores and moist limestone flats	6E(1,2,4,5, 14), 7E(2)						√				√			√		
ASTERACEAE *Chrysanthemum arcticum* Arctic Daisy S3																	
ASTERACEAE *Cirsium drummondii* Drummond's Thistle S1	Prairie	3W;4W					√										
ASTERACEAE *Cirsium flodmanii* Flodman Thistle S2?	Prairie, open woods	4W					√									√	√
ASTERACEAE *Cirsium hillii* Prairie Thistle S3	sand dunes, sandy woods, limestone pavement and open woods on limestone	5E(2); 6E(2,4,6,14)	√			√										√	
ASTERACEAE *Cirsium pitcheri*[T] Dune Thistle S2	sand dunes, beaches	3W;3E				√						√					
ASTERACEAE *Coreopsis tripteris* Tall Coreopsis S2	damp prairies, thickets, open woods	7E(1)					√									√	√
ASTERACEAE *Echinacea pallida* Pale Purple Coneflower S1	dry, open places; prairies[3]	7E(2)					√										
ASTERACEAE *Eclipta prostrata* Yerba de Tajo S2	muddy soil[3], shorelines	7E						√				√			√		
ASTERACEAE *Erigeron glabellus* Smooth Fleabane S1	prairies and open ground[3]	4W					√										
ASTERACEAE *Erigeron humilis* Low Fleabane S1	NO INFORMATION																
ASTERACEAE *Eupatorium altissimum* Tall Boneset S1	Alvars, open woodlands and savannah, adventive along railways and roadsides	7E(1)	√														
ASTERACEAE *Eupatorium maculatum ssp. bruneri* Spotted Joe Pye Weed S2?	NO INFORMATION																
ASTERACEAE *Eupatorium purpureum* Purple-jointed Joe Pye Weed S3	Moist woolands, usualtu riparian	6E(1,7); 7E						√								√	
ASTERACEAE *Euthamia gymnospermoides* Viscid Grass-leaved Goldenrod S1	prairie	7E(1)					√										
ASTERACEAE *Gnaphalium sylvaticum* Woodland Cudweed S3?	Open woos and edges															√	√
ASTERACEAE *Heterotheca villosa* Prairie Golden Aster S1	dry, open areas, prairies and waste places, occasionally adventive along railways	3S;4S;3W;4W					√		√								
ASTERACEAE *Hieracium paniculatum* Panicled Hawkweed S2	dry open woods and sandy slopes	6E(10);7E(2,3,5)														√	
ASTERACEAE *Hieracium venosum* Rattlesnake Hawkweed S2	open, dry sand woods	5E(1);6E(1,9); 7E(2,3,5)														√	
ASTERACEAE *Hymenoxys herbacea* Lakeside Daisy S2	open limestone pavement[3]	5E(2);6E(14)	√														
ASTERACEAE *Krigia biflora* Two-flowered Cynthia S2	Open woodlands, meadows and fields, prairies	7E(1,2)					√									√	
ASTERACEAE *Lactuca floridana* Woodland Blue Lettuce S2	dry, deciduous woods	7E(1)														√	√
ASTERACEAE *Liatris aspera* Rough Blazing-star S2	open, sandy woods, dry roadsides and sandy prairies	6E(1)					√			√							√
ASTERACEAE *Liatris cylindracea* Cylindrical Blazing-star S3	limestone and dolostone pavement, prairies[3], open woods	5E(2);6E(7,8)	√				√			√						√	
ASTERACEAE *Liatris spicata*[V] Dense Blazing-star S3	Prairies, savannahs and open sandy woods, occasionally adventive	7E(1,2)					√			√						√	√
ASTERACEAE *Matricaria maritima ssp. phaeocephala* Chamomile S3?																	

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description[3]**	**Site Region[2] (Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
ASTERACEAE *Ratibida pinnata* Gray-headed Coneflower S2 S3	Prairies, open sandy woods	7E(1,2)	√				√						√			√	√
ASTERACEAE *Senecio eremophilus* Groundsel S1	Talus slopes	4W(2)															
ASTERACEAE *Senecio obovatus* Roundleaf Ragwort S3	rocky woods and shaded shorelines, alvar woodland	5E(2);6E(4,14)	√													√	
ASTERACEAE *Senecio plattensis* Prairie Ragwort S2S3	Prairies, savannahs and dry open places[3]	7E(2)					√			√							
ASTERACEAE *Silphium laciniatum* Compass Plant S1	prairies, probably one native site, rarely introduced elsewhere[3], along railways	7E(2)					√										
ASTERACEAE *Silphium perfoliatum* Cup Plant S2	riverbanks, floodplains and moist fields; planted, escaped elsewhere[3]	7E(1,2)						√									
ASTERACEAE *Silphium terebinthinaceum* Prairie Dock S1	wet prairies, thickets and roadsides	7E(1)					√										
ASTERACEAE *Solidago arguta* Sharp-leaved Goldenrod S3	mesic to dry woods	6E(1,3,5,7,9,13); 7E(3,4)														√	
ASTERACEAE *Solidago houghtonii* Houghton's Goldenrod S2	marshy limestone pavements and shorelines	5E(2,3); 6E(14)	√									√			√		
ASTERACEAE *Solidago missouriensis* Missouri Goldenrod S2	dry soils and rocky slopes	3W;4W;5S							√								
ASTERACEAE *Solidago nemoralis ssp. decemflora* Gray-stemmed Goldenrod S1 S2	open granitic bedrock ledges on lakeshores; open mesic grasslands	4S					√		√								
ASTERACEAE *Solidago puberula* Downy Goldenrod S2	open, sandy disturbed areas	6E(11,12)															√
ASTERACEAE *Solidago riddellii* Riddell's Goldenrod S2 S3	wet, marshy ground and old fields, prairies	7E(1,2)					√	√			√				√		
ASTERACEAE *Solidago rigida ssp. rigida* Stiff Goldenrod S3	dry, sandy soil, prairies and waste places	4W					√										
ASTERACEAE *Solidago simplex ssp. randii* Goldenrod S3	dolomitic limestone cliffs and pavements, rocky woods and sand dunes	5E(2); 6E(4,14)			√	√						√				√	
ASTERACEAE *Solidago speciosa* Showy Goldenrod S1	prairies and dry thickets	7E(1)					√										
ASTERACEAE *Solidago ulmifolia* Elm-leaf Goldenrod S1	woods, fields	7E(1,2)														√	
ASTERACEAE *Verbesina alternifolia* Wingstem S2 S3	clay banks, sandy thickets, river banks and rich alluvial woods	7E(1,2)						√								√	√
ASTERACEAE *Vernonia gigantea* Giant Ironweed S3	mesic prairies, thickets, moist woods, roadsides and grassy meadows	7E(1,2,3)					√									√	√
AZOLLACEAE *Azolla caroliniana* Mosquito Fern S1	floating on still water of lakes, ponds, creeks and streams; often associated with *Lemna*; may form dense mats on water's surface	6E(10);7E(3)		√											√		
BETULACEAE *Betula lenta* Cherry Birch S1	woods	7E(3)														√	
BETULACEAE *Betula neoalaskana* Alaska Paper Birch S2	Precambrian rocks and acid, peaty soils[3]	2W							√								
BETULACEAE *Betula occidentalis* Spring Birch S3	ridges, slopes, streambanks[3]	2E;2W															
BIGNONIACEAE *Campsis radicans* Trumpet Creeper S2	open, deciduous woods and hedgerows	7E(1)						√								√	√
BORAGINACEAE *Lithospermum canescens* Hoary Puccoon S3?	sandy, or rocky prairie remnants and open woodlands	6E, 7, 5S, 4W					√		√							√	
BORAGINACEAE *Lithospermum incisum* Fringed Puccoon S1	dune,savannah, sandy woods and dry ground	7E(1,2,3,4)				√				√						√	
BORAGINACEAE *Lithospermum latifolium* Broad-leaved Puccoon S3	river floodplains, woods and open areas near edges of woods	6E(1,5);7E(1,2,4,6)						√								√	√

Family, Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
BORAGINACEAE *Mertensia virginica* Bluebells S3	moist or wet deciduous woods and thickets, usually on floodplains, occasional escape from cultivation	6E(8);7E						√								√	
BORAGINACEAE *Myosotis macrosperma* Large-seeded Forget-me-not S1	low, wet woods	7E(1)														√	
BORAGINACEAE *Onosmodium molle* Soft-hairy False-gromwell S2	river banks and flats and dry rocky woods, fields, gravelly soil, stable sand dune ridges	6E(1,2,5);7E(1,2)				√		√								√	
BRASSICACEAE *Arabis alpina* Alpine Rock-cress S1	calcareous shoreline gravels and meadows	1E										√					
BRASSICACEAE *Arabis arenicola var. arenicola* Rock-cress S1	blowout sandy beach ridge	1E										√					
BRASSICACEAE *Arabis arenicola var. pubescens* Rock-cress S2	sandy and gravelly beach ridges	1E										√					
BRASSICACEAE *Arabis divaricarpa var. dacotica* Purple Rock-cress S3?	NO INFORMATION																
BRASSICACEAE *Arabis hirsuta ssp. adpressipilis* Hairy Rock-cress S1	Rocky calcareous woodland and edges	7E														√	√
BRASSICACEAE *Arabis shortii* Toothed Rock-cress S2	shady thickets and rocky woodland	7E(1)														√	√
BRASSICACEAE *Cardamine pratensis ssp. angustifolia* Cuckoo Flower S2 S3	NO INFORMATION																
BRASSICACEAE *Cochlearia groenlandica* Greenland Cochlearia S1	coastal supratidal meadow at edges of dry sand ridges	1E										√					
BRASSICACEAE *Draba alpina* Alpine Whitlow-grass S2?																	
BRASSICACEAE *Draba cinerea* Gray-leaved Whitlow-grass S1	open sand or gravel of dry coastal beach ridges	1E										√					
BRASSICACEAE *Draba nivalis* Little Snow Whitlow-grass S1	raised and open sand-gravel beach ridges	1E										√					
BRASSICACEAE *Draba reptans* Carolina Whitlow-grass S2	dry sandy areas, dry open flats, limestone pavements	6E(8,15);7E(1,2)	√			√						√					
BRASSICACEAE *Neobeckia aquatica* Lake-cress S3?	lakes and rivers[7]	5E(5);6E(10,12)		√											√		
BRASSICACEAE *Subularia aquatica* Water Awlwort S3?	Shallow sandy lake margins	5E(5)		√								√			√		
CACTACEAE *Opuntia fragilis* Little Prickly Pear Cactus S2	exposed bedrock, rocky open areas	4W;5E(11,13)							√								
CACTACEAE *Opuntia humifusa*[7] Eastern Prickly Pear Cactus S1	dry sandy soil in open savannahs, sand dunes and ridges	7E(1)				√				√							
CALLITRICHACEAE *Callitriche heterophylla* Large Water Starwort S2?	Ponds, lakes, muddy shores[7]			√								√			√		
CAPRIFOLIACEAE *Triosteum angustifolium* Narrow-leaved Tinker's-weed S1	dry open calcareous woods	7E(1)	√													√	
CAPRIFOLIACEAE *Triosteum perfoliatum* Perfoliate Tinker's-weed S1	Rich deciduous woods	7E(1)														√	
CARYOPHYLLACEAE *Arenaria humifusa* Low Sandwort S2 S3	wet, often mossy places along rivers and streams	1E,3W						√									
CARYOPHYLLACEAE *Cerastium alpinum* Alpine Chickweed S3?																	
CARYOPHYLLACEAE *Cerastium brachypodum* Short-pedicelled Chickweed S1	Open alvar pavement	6E	√														
CARYOPHYLLACEAE *Cerastium velutinum* Long-hairy Chickweed S3	Lopen limestone woods and edges	7E(1)	√						√							√	√
CARYOPHYLLACEAE *Minuartia groenlandica* Mountain Sandwort S1	cliff tops and open rock summits of Precambrian intrusive uplands of Sutton Ridges	1E			√												

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
CARYOPHYLLACEAE *Minuartia rubella* Boreal Stitchwort S1	gravelly ground, usually more or less calcareous	1E															
CARYOPHYLLACEAE *Moehringia macrophylla* Large-leaved Sandwort S2	rocky ledges, open rocky woodlands and talus slopes	3E;3W;4W			√				√				√			√	
CARYOPHYLLACEAE *Paronychia canadensis* Tall Forked Chickweed S1	woods	7E(1)														√	
CARYOPHYLLACEAE *Paronychia fastigiata* Low Forked Chickweed S1	clay or clay-loam soil in clearings and opening of mixed deciduous woodlands	7E(3,5)														√	
CARYOPHYLLACEAE *Silene involucrata* Arctic Campion S1 S2	gravelly tundra	1E												√			
CARYOPHYLLACEAE *Silene uralensis* Apetalous Catchfly S1	tundra, usually damp gravelly places	1E												√			
CARYOPHYLLACEAE *Spergularia canadensis* Canada Sand-spurrey S2	salt marshes and shores	2E										√			√		
CARYOPHYLLACEAE *Stellaria humifusa* Low Starwort S2 S3	salt marshes and coastal ponds	1E;2E													√		
CELASTRACEAE *Euonymus atropurpurea* Burning Bush S3	dry to moist thickets and woods	7E														√	√
CERATOPHYLLACEA *Ceratophyllum echinatum* Spiny Hornwort S3		5E		√											√		
CHENOPODIACEAE *Chenopodium bushianum* Village Goosefoot S1 S2	Disturbed open areas, often riparian							√				√					
CHENOPODIACEAE *Chenopodium foggii* Fogg's Goosefoot S2	sandy areas on limestone under oak or pine-oak forests	6E(6,10);7E(1,2)								√						√	
CHENOPODIACEAE *Chenopodium leptophyllum* Narrow-leaved Goosefoot S1	sandy blowouts under deciduous vegetation; shaley cliffs	7E(1)			√											√	
CHENOPODIACEAE *Chenopodium pratericola* Goosefoot S1 S3	Open rocky ground	4W, 5S					√		√								
CHENOPODIACEAE *Chenopodium standleyanum* Woodland Goosefoot S2	dry deciduous or mixed forests	7E(1)														√	
CHENOPODIACEAE *Corispermum americanum* Bugseed S1 S3	Dry, sandy open areas					√											
CHENOPODIACEAE *Corispermum hookeri* Bugseed S1 S3	Dry, sandy open areas					√											
CHENOPODIACEAE *Corispermum pallasii* Bugseed S1 S3	Dry, sandy open areas					√											
CHENOPODIACEAE *Corispermum villosum* Bugseed S1 S3	Dry, sandy open areas					√											
CHENOPODIACEAE *Suaeda calceoliformis* Sea-blite S2	saline and alkaline areas, rarley adventive on saline roadsides in S. Ont.	2E;7E(6)										√			√		
CISTACEAE *Hudsonia tomentosa* Sand-heather S2 S3	sand dunes and other dry sandy open areas, occasionally adventive especially on dry roadsides	5E(12)				√											
CISTACEAE *Lechea pulchella* Pretty Pinweed S1	prairies and open fields and sandy woods	7E(1)					√									√	
CISTACEAE *Lechea villosa* Hairy Pinweed S3	dry prairies and open sandy woods	7E(1,2)					√									√	
CLUSIACEAE *Hypericum gentianoides* Orange-grass St. John's-wort S1	open sandy areas, prairies	7E(1)					√										
CLUSIACEAE *Hypericum prolificum* Shrubby St. John's-wort S2	fields, prairies and open woods	6E(1);7E(1,2)					√									√	√
CLUSIACEAE *Hypericum sphaerocarpum* Round-fruited St. John's-wort S1	Disturbed open areas, perhaps adventive																
CLUSIACEAE *Triadenum virginicum* Marsh St. John's-wort S3	bogs, swamps, beaver dams, sandy, muddy or rocky lake shorelines	5E(7,8,11); 6E(6,10,12)										√			√		

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description[2]**	**Site Region[3] (Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
COMMELINACEAE *Tradescantia ohiensis* Ohio Spiderwort S2	prairies, wet meadows, moist open oak woodlands	7E(1)					√									√	√
CONVOLVULACEAE *Ipomoea pandurata* Wild Sweet Potato S1	sandy clearings in woods or fields	7E(1)														√	√
CUSCUTACEAE *Cuscuta campestris* Field Dodder S2	marsh,creek banks and pond margins; also cultivated fields - parasitic on *Ambrosia,Aster, Bidens, Circaea, Daucus, Linum, Malva, Medicago, Melilotus, Polygonum, Trifolium*	6E(1,6,12); 7E(1,5,6)						√							√		
CUSCUTACEAE *Cuscuta cephalanthi* Button-bush Dodder S2	moist ditches, creek and pond edges and floodplain woods - parasitic on *Aster, Decodon, Lythrum, Polygonum, Pycnathemum,Solidago*	4W;6E(10);7E(1,5)						√								√	
CUSCUTACEAE *Cuscuta coryli* Hazel Dodder S1	open, moist tall-grass prairie and meadows - parasitic on *Aster, Helianthus, Monarda, Rubus, Solidago*	7E(1,2)					√										
CYPERACEAE *Blysmus rufus* Red Bulrush S3	coastal and estuarine sites; upper intertidal marshes; most frequently supertidal meadow marshes in *Festuca rubra* communities	1E;2E										√			√		
CYPERACEAE *Bulbostylis capillaris* Hair-like Bulbostylis S3?	on lakeshores or river margins in moist or dry sand or gravel or cracks in rocks, sometimes adventive along railways and roadsides	5E(7,8,10,12); 6E(9,10);7E(1)							√			√					
CYPERACEAE *Carex aggregata* Smooth Clustered Sedge S1	dry clearings in open hackberry forest	7E(1)														√	√
CYPERACEAE *Carex alata* Winged Oval Sedge S1	swampy deciduous woods	7E(2)													√	√	
CYPERACEAE *Carex albicans var. albicans* Blunt-scaled Oak Sedge S2	Open sandy or rocky woods	7E														√	
CYPERACEAE *Carex albicans var. emmonsii* Sharp-scaled Oak Sedge S1	Heath bog	7E														√	
CYPERACEAE *Carex amphibola* Gray Sedge S2	Moist woods	7E														√	
CYPERACEAE *Carex annectens var. annectens* Large Yellow Fox Sedge S1	Open alvar woodland	6E	√													√	
CYPERACEAE *Carex annectens var. xanthocarpa* Small Yellow Fox Sedge S2	Dry open woods, edges and fields	7E					√									√	√
CYPERACEAE *Carex appalachica* Appalachian Sedge S2 S3	Rich woods	7E														√	
CYPERACEAE *Carex assiniboinensis* Assiniboia Sedge S1	wet-mesic forests	5S														√	
CYPERACEAE *Carex atlantica* Atlantic Star Sedge S1	clearings in shrubby bogs	6E(12)													√		
CYPERACEAE *Carex atratiformis* Black Sedge S2	rocky shores, wet rocks and cliffs (north shore of Lake Superior)	3W;4W			√							√					
CYPERACEAE *Carex bicknellii* Copper-shouldered Oval Sedge S2	open prairie and open oak woods, usually dry	7E(1)					√		√							√	
CYPERACEAE *Carex bigelowii* Bigelow's Sedge S1	summit rocks and cliff faces	1E			√												
CYPERACEAE *Carex capillaris ssp. krausei* Krause's Sedge S1	NO INFORMATION																
CYPERACEAE *Carex careyana* Carey's Wood Sedge S2	mesic to dry-mesic hardwood forests, floodplain woods	6E(1);7E(2)						√								√	
CYPERACEAE *Carex conoidea* Prairie Gray Sedge S3	rock crevices, sand, gravel along lake and river shores in north; sandy grassland associated with prairie species in south	4W;5E(10);6E(6); 7E(1,6)					√					√					
CYPERACEAE *Carex crus-corvi* Crowfoot Fox Sedge S1	wet woodland depressions	7E(1)														√	
CYPERACEAE *Carex davisii* Awned Graceful Sedge S2	wet-mesic hardwood forests and margins, floodplain woods	7E(1,2)						√								√	√
CYPERACEAE *Carex emoryi* Riverbank Sedge S3	open sedge meadows along river bottoms	7E(1,2)						√							√		

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description[2]**	**Site Region[3]** **(Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
CYPERACEAE *Carex festucacea* Fescue Oval Sedge S1	Open oak woodland and edges	7E(1)														√	√
CYPERACEAE *Carex folliculata* Follicle Sedge S3	bogs, wet shorelines and cedar swamps	5E(7,8,10);6E(8)													√		
CYPERACEAE *Carex formosa* Awnless Graceful Sedge S3 S4	Forests and edges	6E(1,5,6,8,9,15); 7E(6)														√	√
CYPERACEAE *Carex frankii* Bristly Cattail Sedge S2	moist habitats	7E(1)						√							√	√	
CYPERACEAE *Carex glaucodea* Blue Sedge S1	open oak woodlands and open hawthorn meadows on clay soil	7E(1,5)						√								√	
CYPERACEAE *Carex gracilescens* Slender Wood Sedge S3	wet-mesic hardwood forest	6E(1);7E(1,2,3,4,5)														√	√
CYPERACEAE *Carex haydenii* Long-scaled Tussock Sedge S2	open and shaded wet habitats	3E;4E;5E(7,10)						√							√		
CYPERACEAE *Carex heleonastes* Hudson Bay Sedge S2	fens	1E													√		
CYPERACEAE *Carex hirsutella* Hairy Green Sedge S3	dry-mesic to wet-mesic hardwood forests, edges and old fields	7E(1,3,5)														√	
CYPERACEAE *Carex inops* Sun Sedge S1	open, dry, sand prairies	7E(2)					√										
CYPERACEAE *Carex jamesii* Grass Sedge S3	dry-mesic to wet-mesic hardwood forests often on floodplains	6E(1);7E(1,2,3,6)						√								√	
CYPERACEAE *Carex juniperorum* Juniper Sedge S1	alvar woodlands[3]	6E(15)	√													√	
CYPERACEAE *Carex leavenworthii* Dwarf Bracted Sedge S1	dry places, alvar woodlands	7E(1)	√													√	
CYPERACEAE *Carex loliacea* Sedge S2	bogs, muskegs and black spruce forests	2E;2W;3E;3W;4W													√	√	
CYPERACEAE *Carex lupuliformis* Knobbed Hop Sedge S1	wet wooded habitats	6E(1), 7E													√	√	
CYPERACEAE *Carex marina* Sedge S3?																	
CYPERACEAE *Carex meadii* Mead's Stiff Sedge S2	prairies	7E(1)					√										
CYPERACEAE *Carex mesochorea* Midland Bracted Sedge S1	dry, open woodland[3]	7E(2)					√										
CYPERACEAE *Carex misandra* Short-leaf Sedge S1	NO INFORMATION																
CYPERACEAE *Carex muskingumensis* Swamp Oval Sedge S2	wet-mesic hardwood forests	7E(1)													√	√	
CYPERACEAE *Carex nigromarginata* Black-edged Sedge S1	open deciduous woods on sand	7E(2)														√	
CYPERACEAE *Carex novae-angliae* New England Sedge S3	mesic to mesic-wet hardwood forests	5E(6,8,10);6E(12)														√	
CYPERACEAE *Carex obtusata* Dryland Blunt Sedge S1	open, dry granitic outcrops (in Ontario); dry prairies and open conifer-grasslands	5S					√		√								
CYPERACEAE *Carex oligocarpa* Eastern Few-fruited Sedge S2	dry woods and banks, alvar woodland	6E(13,15);7E(1,2)	√													√	√
CYPERACEAE *Carex praticola* Large-fruited Oval Sedge S2?	Open woods, talus slopes, cliffs	4W, 5S			√				√				√			√	
CYPERACEAE *Carex raymondii* Raymond's Sedge S2	sandy gravel beach ridges	1E										√					
CYPERACEAE *Carex retroflexa* Reflexed Sedge S1	dry grassy openings in rich hardwoods and grassy woodland edges	7E(1)														√	√

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
CYPERACEAE Carex rossii Ross's Sedge S2	Cliffs and talus slopes	3W, 4W				√			√				√				
CYPERACEAE Carex schweinitzii Schweinitz's Sedge S3	Moist woodland and seepages	6E, 7E						√			√				√	√	
CYPERACEAE Carex seorsa Swamp Star Sedge S2	peaty edges of woodland pools, swamp forests	7E(5)													√	√	√
CYPERACEAE Carex shortiana Short's Sedge S1	Hardwood forests and meadows	7E(1)						√								√	
CYPERACEAE Carex squarrosa Narrow-leaved Cattail Sedge S2	mesic to wet hardwood forests, often on floodplains	7E(1,3)						√								√	
CYPERACEAE Carex suberecta Wedge-fruited Oval Sedge S2	moist meadows and shores, prairies	7E(1)					√					√			√		
CYPERACEAE Carex supina Sedge S1	cliff tops	4W			√												
CYPERACEAE Carex swanii Downy Green Sedge S3	Openings and edges in hardwood forests	7E(1,2,5)														√	√
CYPERACEAE Carex tetanica Common Stiff Sedge S3	moist grassland, sandy shores and ditches, prairies, seepages	2E;3E;5S;7E(1,2,8)					√	√			√	√					
CYPERACEAE Carex tincta Tinged Oval Sedge S1	Woodland edges	4W															√
CYPERACEAE Carex trichocarpa Hairy-fruited Lake Sedge S3	Riverbanks	7E(4,6)						√							√		
CYPERACEAE Carex trisperma var. *billingsii* Billings' Three-seeded Bog Sedge S2 S3	bogs	5E, 6E, 7E													√		
CYPERACEAE Carex typhina Common Cattail Sedge S2	wet-mesic hardwood forests	6E(12)						√							√	√	
CYPERACEAE Carex virescens Slender Green Sedge S3	Dry and mesic hardwood forests	7E(2)														√	√
CYPERACEAE Carex wiegandii Wiegand's Sedge S1	black spruce bogs and alder swamps	3E;4E;6E(12)													√		
CYPERACEAE Carex willdenowii Willdenow's Sedge S1	moist to dry deciduous forests, mostly acidic soils	7E(5)														√	
CYPERACEAE Carex williamsii William's Sedge S1	moist tundra	1E												√			
CYPERACEAE Carex xerantica Dry Sedge S1	Cliff tops, talus slopes	4W			√								√				
CYPERACEAE Cyperus dentatus Toothed Flat Sedge S1	open, sandy shores of lakes and rivers	6E(12)										√			√		
CYPERACEAE Cyperus erythrorhizos Red-rooted Nut Sedge S3	marshes and moist shores	7E(1,2)										√			√		
CYPERACEAE Cyperus flavescens Yellow Flat Sedge S2	damp sand, moist shores	7E(2)										√			√		
CYPERACEAE Cyperus houghtonii Smooth Sand Sedge S3?	Dry open sandy areas	5E(10,11); 6E(6,10,12)				√						√					
CYPERACEAE Cyperus schweinitzii Rough Sand Sedge S3	Dry open sandy areas	5S, 7E				√						√					
CYPERACEAE Eleocharis engelmannii Engelmann's Spike-rush S1	moist to wet, open, sandy to muddy ground; usually shores	7E(1,2)										√			√		
CYPERACEAE Eleocharis equisetoides Horse-tail Spike-rush S1	wet marshes and shallow water	7E(2)		√											√		
CYPERACEAE Eleocharis geniculata Knee Spike-rush S1	wet and sandy shores	7E(1,2)										√			√		
CYPERACEAE Eleocharis halophila Salt-marsh Spike-rush S3?	wetlands	2E									√				√		

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description**[2]	**Site Region**[2] **(Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
CYPERACEAE *Eleocharis kamtschatica* Kamtschatka Spike-rush S2	supratidal meadows and shallow water	2E		√											√		
CYPERACEAE *Eleocharis nitida* Slender Spike-rush S2	seeps	7E										√			√		
CYPERACEAE *Eleocharis quadrangulata* Angled Spike-rush S1	ponds, wet meadows and shores	7E(1,2)										√			√		
CYPERACEAE *Eleocharis rostellata* Wicket Spike-rush S3	fens and shores	6E(5,6,14)										√			√		
CYPERACEAE *Eriophorum callitrix* Sheathed Cotton-grass S2	NO INFORMATION																
CYPERACEAE *Eriophorum scheuchzeri* Scheuchzer Cotton-grass S2 S3	NO INFORMATION																
CYPERACEAE *Fimbristylis puberula* Hairy Fimbristylis S1	prairie	7E					√										
CYPERACEAE *Kobresia bellardii* Kobresia S1	low shrub fens and willow thickets	1E													√		
CYPERACEAE *Lipocarpha micrantha*[7,?] Dwarf Bulrush S1	Moist sandy shores	7E(1)										√			√		
CYPERACEAE *Scirpus clintonii* Clinton's Bulrush S2	prairie and open woods in south; shorelines, rock crevices in north	3E;4W;5E(10); 6E(6);7E(1,3,4)					√		√			√				√	
CYPERACEAE *Scirpus expansus* Woodland Bulrush S1	Seeps, stream edges	7E									√				√		
CYPERACEAE *Scirpus georgianus* Bristleless Dark Green Bulrush S1?															√		
CYPERACEAE *Scirpus heterochaetus* Slender Bulrush S2	marshes and shores	2W;3E;3W;4W; 5E(5,7);6E(12)										√			√		
CYPERACEAE *Scirpus maritimus* Saltmarsh Bulrush S2 S3	coastal and estuarine intertidal marshes and supertidal meadow	1E;2E										√			√		
CYPERACEAE *Scirpus purshianus* Pursh's Tufted Bulrush S1 S2	wet shores and beaches											√			√		
CYPERACEAE *Scirpus smithii* Smith's Tufted Bulrush S2?	wet shores and beaches	5E(7);6E(1,6,9,12, 13); 7E(2,4)										√			√		
CYPERACEAE *Scirpus verecundus* [V] Small-flowered Bulrush S1	Dry, open slopes in hardwood forests	7E(3,4)														√	
CYPERACEAE *Scleria pauciflora* Few-flowered Nut-rush S1	Sandy, prairies remnant	7E(1)					√										
CYPERACEAE *Scleria triglomerata* Tall Nut-rush S1	moist prairie and thicket	7E(1,4,6)					√										
CYPERACEAE *Scleria verticillata* Low Nut-rush S3	moist, sandy meadows and shores	6E(2,6,8,14,15); 7E(2)										√					
CYPERACEAE *Carex gravida* Long-awned Bracted Sedge S1	dry open ground, prairie	5S;7E(1)					√	√									
DRYOPTERIDACEAE *Cystopteris laurentiana* Laurentian Bladder Fern S2 S3	cliffs	6E, 3W			√				√								
DRYOPTERIDACEAE *Cystopteris montana* Mountain Bladder Fern S1	rich, moist calcareous soil in mixed and coniferous woods	3W;4W														√	
DRYOPTERIDACEAE *Cystopteris protrusa* Lowland Brittle Fern S2	open deciduous woodlands on sandy loam; alluvial river terraces and hillsides that border streams or rivers	7E(1,2,5,6)						√								√	
DRYOPTERIDACEAE *Gymnocarpium jessoense* Northern Oak Fern S3	cliffs	3W, 4W			√				√				√				
DRYOPTERIDACEAE *Gymnocarpium robertianum* Limestone Oak Fern S2	ledges and slopes in calcareous rock; occasionally in sphagnum mats in cedar swamps	3E;3W;4E;4W; 5E(2,11)							√						√		
DRYOPTERIDACEAE *Polystichum braunii* Braun's Holly Fern S3	deciduous mixed woods on talus slopes, rocky ravines and streambeds	3W;4E;4W;5E(2); 6E(1,7)			√			√	√							√	

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
DRYOPTERIDACEAE *Woodsia alpina* Northern Woodsia S2	moist, cool, often shaded crevices in calcareous cliffs	3E;3W;4E;4W; 5E(8,11)			√												
DRYOPTERIDACEAE *Woodsia glabella* Smooth Woodsia S3	shaded, calcareous rock crevices[3]	3E;3W;4E;4W;5E(1,9,10)			√								√				
DRYOPTERIDACEAE *Woodsia obtusa*[7] Blunt-lobed Woodsia S1	open woods on granite slopes	6E(9,10)							√							√	
DRYOPTERIDACEAE *Woodsia oregana* Western Woodsia S3	shaded, calcareous ledges and cliffs	3W;4W;5E(2,10); 6E(4,11,14)	√		√				√				√				
DRYOPTERIDACEAE *Woodsia scopulina* Rocky Mountain Woodsia S3	moist to dry shaded crevices and ledges in acidic rock	3W;4E;4W;5E(9,10)			√				√								
ELATINACEAE *Elatine triandra* Long-stemmed Waterwort S3	shallow water along sandy or muddy lakeshores and river margins	4W;5E(3,4,7,10,11); 5S; 6E(12)		√				√				√			√		
ERICACEAE *Kalmia microphylla* Alpine Bog-laurel S2?	mossy, inter-ridge tundra and spruce woodland	1E												√		√	
ERICACEAE *Phyllodoce caerulea* Mountain-heath S1	forested beach ridges	1E										√		√			
ERICACEAE *Rhododendron canadense* Rhodora S1	drier areas of bogs	6E(12)													√		
ERICACEAE *Vaccinium membranaceum* Mountain Bilberry S1	moist, mature white birch, balsam fir, white cedar forests on shallow, acid soils	3E														√	
ERICACEAE *Vaccinium ovalifolium* Blue Bilberry S2	mixed woods	3E;4E;5E(1)														√	
ERICACEAE *Vaccinium stamineum*[7] Deerberry S1	woods with shallow soils	6E(10);7E(4,5)														√	√
EUPHORBIACEAE *Euphorbia commutata* Tinted Spurge S1	dry, shady slopes, rocky thickets, limestone barrens and ridges	5E(11);6E(15);7E(2)	√						√							√	
EUPHORBIACEAE *Euphorbia obtusata* Blunt-leaved Spurge S1	open, oak savannahs, fields and roadsides	7E(1)								√						√	√
FABACEAE *Amorpha fruticosa* Indigo Bush S1	rich open or partially shaded ground and roadsides	7E(1)						√									
FABACEAE *Astragalus americanus* Milk-vetch S1	forest openings on riverbanks	1E						√								√	
FABACEAE *Astragalus australis* Milk-vetch S1	sandy-gravel and boulder beaches	4E										√					
FABACEAE *Astragalus neglectus* Cooper's Milkvetch S3	open woods, frequently on limestone plains[3]	6E(9,11, 14), 7E	√					√								√	√
FABACEAE *Astragalus tenellus* Milk-vetch S1	dry, south-facing juniper-aspen river slopes	2E						√									
FABACEAE *Baptisia tinctoria* Yellow Wild Indigo S2	prairies, roadsides and sandy open woods	7E(1,2)					√		√							√	
FABACEAE *Cassia hebecarpa* Wild Senna S1	roadsides, riverflats and open fields	7E(1,5)						√									
FABACEAE *Dalea purpurea* Purple Prairie Clover S1	open, sandy or rocky areas	5S;7E(2)					√		√								
FABACEAE *Desmodium canescens* HoaryTick-trefoil S2	sandy woods and thickets and open river banks	7E(1,2)					√	√								√	√
FABACEAE *Desmodium cuspidatum* Bracted Tick-trefoil S3	Rich, open woodlands	7E								√						√	
FABACEAE *Desmodium rotundifolium* Round-leaved Tick-trefoil S2	sandy woods	6E(10);7E(1,2,3,5,6)					√			√						√	√
FABACEAE *Gleditsia triacanthos* Honey Locust S2	mesic to wet forests and forest edges on rich bottomlands; in Ontario also on stabilized sand spits and dunes, frequently planted	7E(1,2,3,5)				√									√	√	
FABACEAE *Glycyrrhiza lepidota* Wild Licorice S1	open, sandy or rocky riverbanks	5S;6E(1);7E(5)						√				√					

Family Family Name[1] Scientific Name Common Name NHIC ranking	**Habitat Description[2]**	**Site Region[3] (Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
FABACEAE *Gymnocladus dioica*[7,7] Kentucky Coffee-tree S2	floodplains, edges of marshes and shallow soil over limestone	7E(1,2,6)	√					√								√	√
FABACEAE *Lespedeza violacea* Violet Bush-clover S1	open woods and gravel beaches	7E(1,3,5)										√				√	√
FABACEAE *Lespedeza virginica*[f] Slender Bush-clover S1	prairies and thickets	7E(1)					√									√	
FABACEAE *Lupinus perennis* Wild Lupine S3	dry, sandy oak savannahs and prairies; open forests and forest edges	6E(13);7E					√			√						√	√
FABACEAE *Oxytropis deflexa var. foliolosa* Stemless Locoweed S2	open river flats and banks and beach ridges	1E;2W						√				√					
FABACEAE *Oxytropis deflexa var. sericea* Blue Pendant-pod Oxytrope S1	littoral areas	1E		√													
FABACEAE *Oxytropis splendens* Showy Locoweed S3	shores[7], cliffs	3W, 4W			√			√				√					
FABACEAE *Oxytropis viscida var. hudsonica* Locoweed S3	beach ridges and floodplains	1E;2E;3E						√				√					
FABACEAE *Oxytropis viscida var. viscida* Stemless Locoweed S1	cliffs	4W			√												
FABACEAE *Strophostyles helvola* Trailing Wild Bean S3	sand beaches and prairies	6E(10);7E					√					√			√		
FABACEAE *Tephrosia virginiana*[7] Goat's Rue S1	dry, sandy open woods	7E(2)								√						√	
FABACEAE *Vicia caroliniana* Wood Vetch S2	dry woods, thickets and prairies	6E(15);7E(1,2,3,5,6)					√	√								√	
FAGACEAE *Castanea dentata*[7] American Chestnut S3	moist to well drained forests on sand, occasionally heavy soils	7E														√	
FAGACEAE *Quercus ellipsoidalis* Northern Pin Oak S3	open habitats or on edges of closed forests	4W;5S;7E(2,5,6)							√								√
FAGACEAE *Quercus ilicifolia* Scrub Oak S1	Precambrian rock outcrops	5E(11)							√								√
FAGACEAE *Quercus palustris* Pin Oak S3	lowland deciduous forests (wet soils)	7E(1,3,5)								√					√	√	√
FAGACEAE *Quercus prinoides* Dwarf Chinquapin Oak S2	open, dry sandy places, savannahs	7E(2)				√				√							
FAGACEAE *Quercus shumardii*[Y] Shumard's Oak S3	mesic and mesic -hydric sites on clay and clay-loam soils with poor drainage	7E(1,2,3)													√	√	√
FUMARIACEAE *Corydalis flavula* Yellow Corydalis S2	sandy or rocky woods and lakeshores	7E(1,2,5)										√				√	
GENTIANACEAE *Bartonia paniculata*[Y] Twining Bartonia S1	sphagnum bogs	5E(7)													√		
GENTIANACEAE *Bartonia virginica* Yellow Screwstem S2	open to slightly shaded moist *Polytrichum* and *Sphagnum* mats	5E(7);6E(1,6)													√		
GENTIANACEAE *Frasera caroliniensis*[Y] Carolina Gentian S1	woodlands on sandy and clay soils	7E(2,3,4,5,6)														√	
GENTIANACEAE *Gentiana flavida*[f] White Prairie Gentian S1	dry to mesic oak savannah on silty-loam soil	6E(8);7E(1)								√							
GENTIANACEAE *Gentianella quinquefolia* Stiff Gentian S2	moist soil, roadsides, streambanks and edges of woods; prairies	6E(2,3,5,9,10); 7E(1,2,4,6)					√	√									√
HIPPOCASTANACEA *Aesculus glabra* Ohio Buckeye S1	mesic deciduous, riparian woods and roadsides	7E(1)						√								√	
HYDROPHYLLACEAE *Hydrophyllum appendiculatum* Appendaged Water Leaf S2	deciduous woods	7E(1,2,6)						√								√	
HYDROPHYLLACEAE *Phacelia franklinii* Wild Heliotrope S2	sand and gravel roadsides, lakeshores and river banks	3W;4W						√				√	√				

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
HYDROPHYLLACEAE *Phacelia purshii* Miami Mist S1	rich woods and clearings, alvar woodland	7E(1)	√													√	
IRIDACEAE *Iris brevicaulis* Leafy Blue-flag S1	wet woods	7E(1)													√	√	
IRIDACEAE *Iris lacustris* Dwarf Lake Iris S3	dunes, sandy woods and shallow soil over limestone	5E(2);6E(2,14)	√			√						√			√	√	
IRIDACEAE *Sisyrinchium albidum* White Blue-eyed Grass S1	prairies	7E(1)					√										
ISOETACEAE *Isoetes engelmannii* Appalachian Quillwort S1	lakes[7]	5E		√								√					
ISOETACEAE *Isoetes riparia* River Bank Quillwort S3	aquatic, on mud or gravel in shallow water	5E(11);6E(8,9,12)		√								√					
ISOETACEAE *Isoetes tuckermanii* Tuckerman's Quillwort S1	lakes[7]	5E		√								√					
JUGLANDACEAE *Carya laciniosa* Big Shellbark Hickory S3	wet or wet -mesic deciduous forests	7E(1,2,3,5)													√	√	
JUGLANDACEAE *Carya ovalis* Sweet Pignut Hickory S3	dry to dry-mesic deciduous forests and savannahs	7E(1,2,3,4,5)								√						√	
JUNCACEAE *Juncus acuminatus* Sharp-fruit Rush S3	sandy and gravelly shorelines, ditches and gravel pits	6E(6)					√					√			√		
JUNCACEAE *Juncus arcticus* Arctic Rush S2S3	brackish marshes, treed fens, sand dunes, beach ridges and disturbed gravelly areas	1E				√						√			√		
JUNCACEAE *Juncus biflorus* Two-flowered Rush S1	open, mesic, sandy prairies	7E(1,2)					√										
JUNCACEAE *Juncus brachycarpus* Short-fruited Rush S1	moist, sandy sites in tall-grass prairies	7E(1)					√										
JUNCACEAE *Juncus castaneus* Chestnut Rush S3?	bogs														√		
JUNCACEAE *Juncus greenei* Greene's Rush S3	beaches, crevices, in limestone; roadsides and dry open prairies	5E(7);6E(12,15), 7E(1,2)				√	√					√					
JUNCACEAE *Juncus interior* Inland Rush S2	crevices in granite along lakeshores and open woodland in prairies	4S,4W,5S					√		√			√					
JUNCACEAE *Juncus longistylis* Long-styled Rush S3	riparian	4W(1), 2E													√		
JUNCACEAE *Juncus marginatus* Grass-leaved Rush S2	open, mesic, sandy prairies	7E(1,2,5)					√										
JUNCACEAE *Juncus militaris* Bayonet Rush S3S4	lake and river shores[7]	5E(7,8)										√			√		
JUNCACEAE *Juncus secundus* Secund Rush S2	crevices in granitic rocks in open areas, alvars	5E(10);6E(9,10,11)	√						√								
JUNCACEAE *Juncus subtilis* Creeping Rush S3	Sandy shores	5E										√					
JUNCACEAE *Juncus tenuis var. anthelatus* Path Rush S1	prairie	7E(1)					√										
JUNCACEAE *Juncus vaseyi* Vasey's Rush S3	sandy, open areas[7]	7E(1), 3w, 5e					√		√								
JUNCACEAE *Luzula confusa* Northern Wood-rush S1	dry, turfy tundra heath, rocky slopes and ledges	1E												√			
JUNCACEAE *Luzula echinata* Wood-rush S1?	Open woods	7E(1)														√	
LAMIACEAE *Blephilia ciliata* Downy Woodmint S1	open ground and thickets on limestone plains	7E(1)	√														
LAMIACEAE *Blephilia hirsuta* Hairy Woodmint S1	Woodlands, often rocky, especially rivers							√								√	

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
LAMIACEAE *Lycopus asper* Rough Water Horehound S2	Marshes, shorelines	6E, 7E										✓			✓		
LAMIACEAE *Lycopus rubellus* Stalked Water Horehound S2	swampy thickets, woodlands and forests	7E(1,2,5)													✓	✓	
LAMIACEAE *Lycopus virginicus* Virginia Bugleweed S2	wet ground	7E(1)						✓				✓			✓		
LAMIACEAE *Monarda didyma* Bee-balm S3	moist woods, swampy thickets and roadsides	5E(6); 6E(1,2,5,11,12); 7E						✓							✓	✓	
LAMIACEAE *Monarda punctata* Spotted Bee-balm S1	sandy open areas	6E(8,12);7E(1,2)															
LAMIACEAE *Monarda x media* Purple Bergamot S1	Woods and edges	7E														✓	✓
LAMIACEAE *Pycnanthemum incanum*[4,6] Hoary Mountain-mint S1	dry woodlands in partial shade of oaks and in openings	7E(3)														✓	
LAMIACEAE *Pycnanthemum tenuifolium* Slender Mountain-mint S3	Dry open areas	6E, 7E															
LAMIACEAE *Pycnanthemum verticillatum var. pilosum* Hairy Mountain-mint S1	openings in sandy woodlands	7E(1)														✓	
LAMIACEAE *Pycnanthemum verticillatum var. verticillatum* Whorled Mountain-mint S1?	NO INFORMATION	7E															
LAMIACEAE *Scutellaria nervosa* Veined Skullcap S1	marshy woodlands or forests	7E(1)						✓							✓	✓	
LAMIACEAE *Scutellaria parvula var. leonardii* Sleonard's Small Skullcap S1	Prairies, rock outcrops	5S, 7E					✓		✓								
LAMIACEAE *Stachys pilosa* Hedge Nettle S1	shorelines	7E										✓					
LAMIACEAE *Trichostema dichotomum* Forked Blue Curls S1	sandy openings in woodlands	7E(2)														✓	✓
LENTIBULARIACEAE *Pinguicula villosa* Hairy Butterwort S2S3	tundra and peaty soils[7]	1E												✓	✓		
LENTIBULARIACEAE *Utricularia geminiscapa* Hidden-fruited Bladderwort S3	bog pools	5E(7,8);6E(9)													✓		
LILIACEAE *Aletris farinosa*[5,7] Colic Root S2	rich sandy woods and thickets; grassy openings in forests; meadows and dry to mesic prairies	7E(1,2)					✓			✓						✓	
LILIACEAE *Allium burdickii* Narrow-leaved Wild Leek S1?	Rich woods	6E, 7E							✓							✓	
LILIACEAE *Allium cernuum* Nodding Onion S2	dry woods, rocky banks and prairies	5S;7E(1)	✓				✓		✓							✓	
LILIACEAE *Allium stellatum* Prairie Onion S2	rocky or sandy prairies; dry savannahs and hills	5S					✓		✓	✓							
LILIACEAE *Camassia scilloides*[7] Wild Hyacinth S2	fields, meadows and moist open deciduous woods	7E(1)													✓	✓	
LILIACEAE *Hypoxis hirsuta* Yellow Star-grass S3	dry open sandy woods: wet to dry meadows and prairies	6E(15);7E					✓			✓							
LILIACEAE *Lilium canadense ssp. editorum* Red Canada Lily S2?	woodlands	6E, 7E														✓	✓
LILIACEAE *Trillium flexipes*[8] Drooping Trillium S1	rich deciduous woods often along river flats or on heavy basic soils associated with limestone	7E(1,2,3)						✓								✓	
LILIACEAE *Uvularia perfoliata* Perfoliate Bellwort S1	rich, mesic woodlands; dry oak-pine woods and thickets	7E(3,5)														✓	
LINACEAE *Linum lewisii* Prairie Flax S2	sandy or gravelly marine shorelines (beach ridges) and limestone outcroppings	1E							✓			✓					
LINACEAE *Linum medium var. medium* Small Yellow Flax S3	rocky, sandy and muddy lakeshores	5E, 6E, 7E(2)										✓			✓		

Family: Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
LINACEAE *Linum medium var. texanum* Small Yellow Flax S1	moist, sandy soil along or near lakeshores	7E(2)										√			√		
LINACEAE *Linum striatum* Ridged Yellow Flax S1	moist, rocky, sandy lakeshores and turfy riverbanks	5E(7)						√				√			√		
LINACEAE *Linum sulcatum* Grooved Yellow Flax S3	prairies and dry, sandy open sites[7]	6E(7,12); 7E(2)					√			√							
LINACEAE *Linum virginianum* Slender Yellow Flax S2	dry, open woods and adjacent fields	7E														√	
LYCOPODIACEAE *Diphasiastrum sabinifolium* Ground-fir S3	sandy woods and meadows[7]	3E; 3W; 4E; 5E															√
LYCOPODIACEAE *Huperzia appalachiana* Appalachian Fir Clubmoss S1	Cliffs, talus slopes	3W; 4W			√				√				√				
LYCOPODIACEAE *Huperzia selago* Fir Clubmoss S3S4	rocky forest openings, bogs[7], cliffs	1E; 3E; 3W; 4E; 4W; 4E; 4S; 5S; 6E			√								√		√	√	√
LYTHRACEAE *Ammannia robusta*[7] Scarlet Ammannia S1	mudflats and wet sandy beaches	7E(1)										√			√		
LYTHRACEAE *Lythrum alatum* Winged Loosestrife S3	wet meadows, moist prairies, open woods and wet, disturbed areas	6E(1,11,13); 7E(1,2,5,6)					√								√	√	
LYTHRACEAE *Rotala ramosior*[7] Toothcup S1	moist, fields, shores	5e(11); 7E(2)										√			√		
MAGNOLIACEAE *Magnolia acuminata*[3,4] Cucumber Tree S2	rich, partly open, moist to wet woods	7E(2,3,5)														√	
MALVACEAE *Hibiscus moscheutos*[7] Swamp Rose Mallow S3	swamp marshes, wet woods and ponds	7E(1,2,3,5)													√	√	
MALVACEAE *Sida hermaphrodita* Virginia Mallow S1	Open shores and thickets	7E						√									√
MELASTOMATACEAE *Rhexia virginica* Virginia Meadow-beauty S3S4	exposed sandy and coarse gravel shorelines with sandy or peaty soils; mainly southern aspects	5E(7,8,9)										√			√		
MONOTROPACEAE *Pterospora andromedea* Giant Pinedrops S2	conifer woods, under pine[7]	4E; 5E; 6E(11,12); 7E														√	√
MORACEAE *Morus rubra*[7] Red Mulberry S2	moist woods and wooded river valleys	6E(7);7E(1,3,4,5)														√	√
MYRICACEAE *Myrica pensylvanica* Bayberry S1	moist sandy woods and marsh margins	7E(2)													√	√	
NAJADACEAE *Najas gracillima* Thread-like Naiad S2	shallow water of lakes and ponds with sandy to peaty substrate	6E(5);7E(2);5E(10)		√											√		
NELUMBONACEAE *Nelumbo lutea* Lotus S2	shallow open water in marshes	6E(6);7E(1,2)		√											√		
NYMPHAEACEAE *Nuphar advena* Yellow Pond Lily S3	alkaline and neutral water 0.5 to 2 m deep	7E		√													
NYSSACEAE *Nyssa sylvatica* Black Gum S3	dry to wet woods and savannahs	7E(1,2,3,5)								√					√	√	
OLEACEAE *Fraxinus profunda* Pumpkin Ash S2	Moist woods	7E						√							√	√	
OLEACEAE *Fraxinus quadrangulata*[7,9] Blue Ash S3	floodplains, shallow soil over limestone	7E(1,2)	√					√								√	√
ONAGRACEAE *Epilobium hornemannii* Hornemann's Willow-herb S1	NO INFORMATION	5E															
ONAGRACEAE *Gaura biennis* Biennial Gaura S2	sandy soil, dry prairies and roadsides	7E(1,2,3,4,5)					√										
ONAGRACEAE *Ludwigia alternifolia* Seedbox S1	prairies and ditch edges	7E(1)					√								√		
ONAGRACEAE *Ludwigia polycarpa* Many-fruited False-loosestrife S2	wet meadows, peat bogs, and wet disturbed areas	7E(1,2,5)													√		

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[2] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
ONAGRACEAE *Oenothera clelandii* Sand Evening-primrose S1	dry sand in open relict prairie under scattered black oaks and sassafras	6E(13); 7E(6)					√										√
ONAGRACEAE *Oenothera pilosella* Prairie Sundrops S2	moist edges of woods and waste ground, prairie	6E(9);7E(2,3,5,6)					√									√	√
ONAGRACEAE *Oenothera villosa* Hairy Evening-primrose S??	Dry open ground	7E															
OPHIOGLOSSACEAE *Botrychium acuminatum* Pointed Moonwort S1	NO INFORMATION																
OPHIOGLOSSACEAE *Botrychium campestre* Prairie Dunewort S1	NO INFORMATION																
OPHIOGLOSSACEAE *Botrychium hesperium* Western Moonwort S1	grassy slopes, edges of lakes, sandy fields and flat roadside ditches	5E(2);3W;4W										√					
OPHIOGLOSSACEAE *Botrychium lanceolatum* Narrow Triangle Moonwort S3	dry to moist open woods and rich mature deciduous forest	5E(7,8,9,11); 6E(6,10,12,13); 7E(4,5)														√	
OPHIOGLOSSACEAE *Botrychium oneidense* Blunt-lobed Grapefern S3	Open woods, sandy old fields	6E, 7E														√	√
OPHIOGLOSSACEAE *Botrychium pallidum* Pale Moonwort S1	NO INFORMATION																
OPHIOGLOSSACEAE *Botrychium pseudopinnatum* False Northwestern Moonwort S1	Sandy old fields	3W															
OPHIOGLOSSACEAE *Botrychium rugulosum* Rugulose Grapefern S2	sandy or silty soil in young *Populus-Prunus-Acer* woods; at edges of*Pinus resinosa* woods and rich *Acer-Fagus* woods, often with *Pteridium*; along roadsides under *Rubus*; and in open exposed, grassy areas near margins of sandy lakes	5E(7);6E(1,6,12,13); 7E(2,6)														√	√
OPHIOGLOSSACEAE *Botrychium spathulatum* Spoon-leaf Moonwort S1	NO INFORMATION																
ORCHIDACEAE *Aplectrum hyemale* Puttyroot S2	moist deciduous woods	6E(6,9,10,12,14); 7E(1,2,3)														√	
ORCHIDACEAE *Coeloglossum viride var. viride* Bracted Orchid S??	NO INFORMATION																
ORCHIDACEAE *Corallorhiza odontorhiza* Autumn Coral-root S2	open, oak-pine woods or occasionally in open, red pine or white pine plantations in sandy areas	7E(2,3)														√	
ORCHIDACEAE *Cypripedium arietinum* Ram's-head Lady's-slipper S3	cedar woodland on limestone plains, wooded fens and sandy sites[3]	6E(9,11,14)	√												√	√	√
ORCHIDACEAE *Cypripedium calceolus var. planipetalum* Flat-petalled Yellow Lady's-slipper S1	open, white spruce forests on limestone	2E														√	
ORCHIDACEAE *Cypripedium candidum*[2,3] Small White Lady's-slipper S1	dry to mesic prairies, marshes, marl fens, and wet grassy meadows	6E(2,9);7E(1,2)					√								√		
ORCHIDACEAE *Isotria medeoloides*[2,3] Small Whorled Pogonia S1	sandy, open deciduous woods	7E(2)														√	
ORCHIDACEAE *Isotria verticillata*[2,3] Large Whorled Pogonia S1	moist deciduous woods	7E(2)													√	√	
ORCHIDACEAE *Liparis lilifolia*[2,3] Purple Twayblade S2	dry sandy sites in open mixed woods, pine plantations and sumac thickets	6E(5);7E(1,2)					√									√	
ORCHIDACEAE *Listera auriculata* Auricled Twayblade S3	moist, shaded sandy soil[3]	2E; 2W; 3E; 3W; 5E						√							√	√	
ORCHIDACEAE *Listera australis* Southern Twayblade S2	in clearings in sphagnum bogs	5E(7,10,11);6E(12)													√		
ORCHIDACEAE *Listera borealis* Northern Twayblade S3	cool, mossy woods and in thickets along river and lake shores	1E;2E;3W						√				√				√	
ORCHIDACEAE *Malaxis paludosa* Bog Adder's-mouth S1	sphagnum bogs and muskegs	3E;3W;4W													√		
ORCHIDACEAE *Platanthera blephariglottis* White Fringed Orchid S3S4	open sphagnum bogs	5E(7,10); 6E(5,6,7,12);7E(5)													√		

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description[3]**	**Site Region[2] (Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
ORCHIDACEAE *Platanthera flava var. herbiola* Tubercled Orchid S3	wet, sandy or peaty open sites[7]	5E; 6E; 7E										√			√		
ORCHIDACEAE *Platanthera grandiflora* Large Purple Fringed Orchid S1	damp meadows and open woods	6E(12)														√	
ORCHIDACEAE *Platanthera leucophaea*[7] Eastern Prairie White Fringed Orchid S2	fens, wet meadows, marshes and prairies	6E(5,6,11);7E(1,6)					√								√		
ORCHIDACEAE *Platanthera macrophylla* Large Round-leaved Orchid S2	moist mixed woods	5E(7);6E(1,6,14)														√	
ORCHIDACEAE *Spiranthes lacera var. gracilis* Southern Slender Ladies'-tresses S1	grassy meadows, prairies	7E(1,2,3,4)					√										
ORCHIDACEAE *Spiranthes magnicamporum* Great Plains Ladies'-tresses S3	sandy meadows, shores and roadsides	6E(4);7E(1,20					√					√					
ORCHIDACEAE *Spiranthes ochroleuca* Yellow Ladies'-tresses S2	sandy meadows, prairies and roadsides	6E(10);7E(1,2,5)					√										
ORCHIDACEAE *Spiranthes ovalis* Oval Ladies'-tresses S1	wet to mesic prairie on calcareous sandy loam and clay soils	7E(1)	√				√										
ORCHIDACEAE *Triphora trianthophora*[7] Nodding Pogonia S1	rich deciduous woods	7E(1)														√	
OROBANCHACEAE *Orobanche fasciculata* Clustered Broomrape S1	shallow soil over limestone	5E(2)	√														
PAPAVERACEAE *Stylophorum diphyllum*[2,8] Wood Poppy S1	rich, wooded riverbanks	6E(1);7E(0)						√								√	
PINACEAE *Pinus rigida* Pitch Pine S2S3	shallow soil on quartzite and granite-gneiss outcroppins or ridges; exposed Potsdam sandstone pavements. Often associated with oaks	6E(10,11)							√								
PLANTAGINACEAE *Plantago cordata*[2,8] Heart-leaved Plantain S1	moist woods, streams, swamps and wet ditches	6E(1);7E(2)						√							√	√	
PLUMBAGINACEAE *Armeria maritima* Western Thrift S3	sandy plains and treeless beach ridges	1E										√		√			
POACEAE *Agrostis hyemalis* Tickle Grass S1	Dry, open ground on limestone	7E(1)	√														
POACEAE *Agrostis mertensii* Northern Benigrass S1	NO INFORMATION																
POACEAE *Alopecurus alpinus* Alpine Foxtail S3	moist, ericaceous heath, low willow thickets, and mossy geminoid meadows in the maritime tundra zone	1E												√			
POACEAE *Ammophila breviligulata* Marram Grass S3	Sandy shores	5E, 6E, 7E				√						√					
POACEAE *Arctagrostis latifolia* Polar Grass S3	damp, mossy tundra and turfy inter-ridge depressions	1E												√			
POACEAE *Arctophila fulva* Pendent Grass S3	shallow, coastal inter-ridge meadow marsh and supratidal freshwater meadow marsh	1E													√		
POACEAE *Aristida basiramea* Forked Three-awn Grass S1	open, dry, acid sand barrens	6E(6)															
POACEAE *Aristida dichotoma* Shinners Three-awn Grass S1	rocky shores[7]	5E(11)							√			√					
POACEAE *Aristida longespica var. geniculata* Three-awn Grass S2	dry sandy soil[7]	7E(1)					√										
POACEAE *Aristida longespica var. longespica* Three-awn Grass S2	dry to moist sandy fields and sandy openings in prairies	6E(15); 7E(1,2)					√										
POACEAE *Aristida purpurascens* Arrow Feather Three-awn Grass S1	dry prairie	7E(1)					√										
POACEAE *Bouteloua curtipendula* Side-oats Grama S2	dry, open limestone plains and prairie openings in dry, sandy oak woods	6E(8,15);7E(2,6)	√				√		√								√
POACEAE *Bromus nottowayanus* Nottoway Brome Grass S1?	woodlands	7E														√	

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
POACEAE *Calamagrostis deschampsioides* Reed Grass S1	brackish marsh, above the high tide level, in shallow peat	1E													√		
POACEAE *Calamagrostis lapponica* Reed Grass S1	dry Precambrian outcrop and clay banks	1E,2E,2W							√								
POACEAE *Calamagrostis purpurascens* Purple Reed Grass S1	exposed cliffs and talus slopes	3W,4W			√								√				
POACEAE *Calamovilfa longifolia var. magna* Sand Reed S3	active sand dunes, open sand plains, and openings in forests on stabilized sand dunes	5E(2,3);6E(2);7E(2)				√											
POACEAE *Danthonia compressa* Flat-stemmed Oat Grass S3	moist to dry open woods, especially in clearings	5E(10);7E(5)							√							√	
POACEAE *Deschampsia atropurpurea* Mountain Hairgrass S1	open spruce-lichen woodland	1E														√	
POACEAE *Diarrhena obovata* Beak Grass S1	Riparian woodlands	7E						√								√	
POACEAE *Digitaria cognatum* Fall Witch Grass S1	dry, sandy fields; prairies; and sand barrens	7E					√										
POACEAE *Echinochloa walteri* Walter's Barnyard Grass S3	marshes along streams and lakes; sometimes on recent, sandy strands along the shores of the Great Lakes	6E(12); 7E(11,2)						√				√			√		
POACEAE *Elymus lanceolatus ssp. psammophilus* Great Lakes Wheatgrass S3	Great Lakes sand dunes	5E, 6E, 7E				√						√					
POACEAE *Elymus trachycaulus ssp. violaceus* Wheatgrass S2	NO INFORMATION																
POACEAE *Elymus virginicus var. submuticus* Wild Rye S2?	NO INFORMATION																
POACEAE *Eragrostis capillaris* Lace Grass S1	Dry open sandy ground	7E(1)															
POACEAE *Eragrostis pilosa* Hairy Love Grass S1	Alvar, disturbed open ground	7E(1)	√														
POACEAE *Eragrostis spectabilis* Purple Love Grass S2	dry, sandy fields; prairies; sand barrens and beaches	5E(11);7E(1,2,3,5,6)					√					√					
POACEAE *Festuca hallii* Rough Fescue S1	sandy soil under jack pine, prairies, cliff top, rock outcrop	4W, 5S			√		√		√							√	
POACEAE *Festuca richardsonii* Arctic Fescue S1?	NO INFORMATION																
POACEAE *Hierochloe alpina* Alpine Sweet Grass S1	exposed rocky summits and cliff tops of Precambrian intrusive outcrops	1E			√				√								
POACEAE *Hierochloe pauciflora* Holy Grass S2	open graminoid coastal meadows, shallow peat fens, and inter-ridge tundra	1E												√	√		
POACEAE *Koeleria macrantha* June Grass S2	prairies; stabilized sand dunes; openings in dry, sandy forests	4W;5S;7E(1,2,6)				√			√							√	
POACEAE *Muhlenbergia racemosa* Upland Wild Timothy S1	rock outcrops and talus slopes, prairie remnants	3W;4W;5S					√		√				√				
POACEAE *Muhlenbergia richardsonis* Soft-leaf Muhly S2	Fens, seepages	4W, 6E, 7E						√	√		√						
POACEAE *Muhlenbergia sobolifera* Rock Satin Grass S1	Alvar woodland	7E(1)	√														
POACEAE *Muhlenbergia sylvatica* Woodland Satin Grass S2	rich deciduous woods, open rocky riparian areas	5E, 6E(8,11);7E(4)						√				√				√	
POACEAE *Muhlenbergia tenuiflora* Slender Satin Grass S2	rich deciduous forest, often on rocky or sandy soil	6E(1,8,10);7E(2,3,6)						√								√	
POACEAE *Panicum clandestinum* Broadleaf Panic Grass S2	deciduous forests, especially along streams; thickets and moist meadows	7E(1,2)						√								√	
POACEAE *Panicum dichotomum* Forked Panic Grass S2	dry to mesic sandy or rocky deciduous forest	6E(10);7E(2,3,4,5)														√	

Family: Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
POACEAE *Panicum gattingeri* Gattinger's Panic Grass S3	sandy or muddy shores of lakes and rivers, roadsides	6E, 7E(2,4,6)						√				√					
POACEAE *Panicum leibergii var. baldwinii* Baldwin's Panic Grass S1S2	dry to mesic prairies, sandy fields and sandy or rocky openings in oak forest; open, rocky riverbanks in northern Ontario	2E,3E,4W, 5S					√	√	√							√	
POACEAE *Panicum leibergii var. leibergii* Leiberg's Panic Grass S1	prairie	6E, 7E					√	√	√								
POACEAE *Panicum meridionale* Mat Panic Grass S1	moist, sandy, acid fields and shores	7E(1)					√					√					
POACEAE *Panicum perlongum* Long-stalked Panic Grass S1S2	dry prairies; dry, sandy fields; and dry sandy or rocky openings in deciduous or mixed forest	4W,5S,6E(13),7E(6)					√		√							√	
POACEAE *Panicum rigidulum* Redtop Panic Grass S2S3	sandy and rocky shores of lakes and rivers, in acid soil	5E(7),6E(9)										√			√		
POACEAE *Panicum sphaerocarpon var. sphaerocarpon* Round-fruited Panic Grass S3	moist to dry sandy fields, prairies and lakeshores, in acid soil	6E(6),7E(1,2,6)					√					√					
POACEAE *Panicum spretum* Sand Panic Grass S2	sandy, acid lakeshores	6E(6)										√			√		
POACEAE *Panicum villosissimum* White-haired Panic Grass S3	Dry open sandy woods, prairie	6E, 7E					√			√						√	√
POACEAE *Paspalum setaceum* Slender Paspalum S2	Dry, open ground, prairie	7E					√										
POACEAE *Phleum alpinum* Mountain Timothy S1S2	dry, open coastal beach ridges, riverside meadows	1E,2E						√				√					
POACEAE *Poa arctica* Arctic Bluegrass S2?	NO INFORMATION																
POACEAE *Poa interior* Inland Bluegrass S3?	Cliffs, rock outcrops	3W, 4W			√			√									
POACEAE *Poa languida* Weak Bluegrass S3	Woods						√									√	
POACEAE *Poa secunda* Canby Bluegrass S1	Cliffs	4W, 5E			√												
POACEAE *Poa sylvestris* Woodland Bluegrass S2	rich, deciduous forests	7E(1)						√								√	
POACEAE *Puccinellia ambigua* Alberton Alkali Grass S2	NO INFORMATION																
POACEAE *Puccinellia tenella* Alkali Grass S1	NO INFORMATION																
POACEAE *Puccinellia vaginata* Arctic Tussock Alkali Grass S1	NO INFORMATION																
POACEAE *Sphenopholis nitida* Shiny Wedge Grass S1	rich deciduous forests	7E(2,3,5)														√	
POACEAE *Sphenopholis obtusata* Prairie Wedge Grass S1	mesic to dry prairies, meadows, forest edges, and open forests	7E(1)					√									√	√
POACEAE *Sporobolus asper* Rough Dropseed S1S2	dry prairies; dry, sandy meadows and shores; roadsides and railway tracks	6E(1,8,12);7E(1,2,5,6)					√					√					
POACEAE *Sporobolus heterolepis* Prairie Dropseed S2	moist to dry limestone plains and calcareous shores	5E(2,3); 6E(8,12,14,15)	√				√										
POACEAE *Sporobolus ozarkanus* Ozark Dropseed S2?	Dry, open ground	6E, 7E	√									√					
POACEAE *Stipa comata* Needle-and-thread S1	prairie	4W, 5S					√										
POACEAE *Stipa spartea* Porcupine Grass S3	dry prairies, open stabilized dunes, and sandy openings in dry deciduous or coniferous forests on dunes	5E(3,4,12);5S; 6E(8,14); 7E(2,6)				√	√		√								
POACEAE *Torreyochloa pallida* Torrey's Manna Grass S2	shallow water and wet shores at edges of streams and ponds; boggy depressions in forests	6E(8,11,12);7E(5)		√				√							√	√	

Family Family Name[1] **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description[2]**	**Site Region[3]** **(Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edges**
POACEAE *Trisetum melicoides* Purple False Oats S3S4	Rocky shores, moist woodlands	5E, 6E										√			√	√	√
POACEAE *Vulpia octoflora* Slender Eight-flowered Fescue S2	dry, sandy meadows; openings in dry sandy forests; open, stabilized dunes	6E(10,15);7E(1,2,3,6)				√										√	
POACEAE *Zizania aquatica var. subbrevis* Wild Rice S1	Wetlands, marshes	6E													√		
POACEAE *Bromus inermis ssp. pumpellianus* Pumpell's Brome Grass S1	sandy soils, prairie relicts[3]	2W;3W;4W;5S					√	√									
PODOSTEMACEAE *Podostemum ceratophyllum* Threadfoot S2	waterfalls and rapids of fast-moving rivers and streams; anchored to submersed rocky substrata by fleshy holdfasts and roothair-like rhizoids	5E(10,11);6E(9,12)		√													
POLEMONIACEAE *Phlox subulata* Moss Phlox S1?	open, sandy woods, and sandy roadsides and lakeshores	6E(10,12);7E(2,3,4)								√		√				√	
POLYGALACEAE *Polygala incarnata*[2] Pink Milkwort S1	open, wet-mesic to dry sandy prairies; wet meadows	7E(1)					√								√		
POLYGONACEAE *Koenigia islandica* Iceland Koenigia S1	salt marsh growing with *Puccinellia* and *Ranunculus*; grows on mudflats and in gravelly, wet places throughout its range	1E													√		
POLYGONACEAE *Polygonella articulata* Coast Jointweed S3	sandy beaches of rivers and lakeshores; sand dunes and hills, sand barrens and sandy openings in jack pine forests; often adventive along sandy or gravelly roadsides and railway embankments	4E;5E(1,5,10,11,12)				√		√								√	
POLYGONACEAE *Polygonum arifolium* Halberd-leaved Tear-thumb S3	wet mucky soil under alders at margin of peat bogs; wet, shaded ground along streams, ponds, swamps and lakes; rick thickets and marshy borders; wet depressions and seepage areas in mature hardwood forests	5E(7);6E(10,12); 7E(1,2,5)						√			√				√	√	
POLYGONACEAE *Polygonum careyi* Carey's Smartweed S3S4	Beaver ponds, wet, sandy or mucky soil at edges of marshes, meadows, swamps, lakes, rivers, streams, ponds; moist, gravel-clay roadsides and ditches	5E(5,7,8,9,10)						√				√			√		
POLYGONACEAE *Polygonum caurianum* Alaska Knotweed S2?																	
POLYGONACEAE *Polygonum erectum* Erect Knotweed S1	moist, silty, clay/loam soils in areas subject to persistent disturbance; edges of actively cultivated fields, dirt farm roads, trampled cattle pastures, farmyards; wet stream edges and floodplain washout areas	7E(1,2,3,4)	√					√									
POLYGONACEAE *Polygonum franktonii* Frankton's Knotweed S1?	shorelines											√					
POLYGONACEAE *Polygonum tenue* Slender Knotweed S2	dry, sandy, open areas in deciduous (often oak woods), prairie meadows; at edges of sand pits	7E(1,2)														√	
POLYGONACEAE *Rumex altissimus* Pale Dock S2?	River edges	7E						√							√		
POLYPODIACEAE *Polypodium appalachianum* Appalachian Polypody S1	shaded rock outcrops[3]	6E(10)			√				√								
POLYPODIACEAE *Polypodium sibiricum* Siberian Polypody S1	NO INFORMATION																
PORTULACACEAE *Montia fontana* Fountain Miner's-lettuce S2	low, shrub meadows; shallow and mossy inter-ridge areas	1E						√									
POTAMOGETONACEAE *Potamogeton bicupulatus* Snail-seed Pondweed S3S4	acidic waters of ponds, lakes and streams, often over sandy or peaty substrates	5E(7,8,9)		√											√		
POTAMOGETONACEAE *Potamogeton confervoides* Algae-like Pondweed S2	acidic waters of bogs, lakes and slow-moving streams	5E(3,7,8)		√											√		
POTAMOGETONACEAE *Potamogeton hillii*[4] Hill's Pondweed S2	highly alkaline waters of ditches, beaver ponds and slow-moving cold waters	5E(2);6E(1,5,14); 7E(2)		√											√		
POTAMOGETONACEAE *Potamogeton subsibiricus* Pondweed S1	fresh to brackish water	1E		√											√		
PRIMULACEAE *Glaux maritima* Sea Milkwort S3?	inter- and supra-tidal areas of salt marshes	2E													√		
PRIMULACEAE *Lysimachia hybrida* River Loosestrife S1	Floodplain, woodland edges	4W															√

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
PTERIDACEAE *Cryptogramma acrostichoides* Mountain Parsley S2	rock crevices, cliffs and dry open woods	2W,4S			√											√	
PTERIDACEAE *Pellaea atropurpurea* Purple-stemmed Cliffbrake S3	crevices and earthen ledges on south-facing calcareous cliffs and rock slopes	3W,5E(2,10,11,12); 6E(4,10,11,14); 7E(3,5)	√		√				√				√				
PYROLACEAE *Chimaphila maculata*[6] Spotted Wintergreen S1	dry, sandy woods	5E(7);6E(6);7E(2,3)														√	
RANUNCULACEAE *Anemone richardsonii* Yellow Anemone S1	NO INFORMATION															√	√
RANUNCULACEAE *Anemonella thalictroides* Rue Anemone S3	decidous woods[7]	6E(10); 7E							√							√	
RANUNCULACEAE *Caltha natans* Floating Marsh-marigold S2	ponds and shallow water	1E,4W		√											√		
RANUNCULACEAE *Cimicifuga racemosa* Black Cohosh S2	open, rich, moist woods	7E(3,4,5)														√	
RANUNCULACEAE *Hydrastis canadensis*[7,7] Golden Seal S2	damp, deciducus woods, often on clay soil	6E(1,5,15);7E(1,2)						√								√	
RANUNCULACEAE *Isopyrum biternatum*[7] False Rue-anemone S2	floodplain woods and rich wooded slopes	7E(2,6)						√								√	
RANUNCULACEAE *Myosurus minimus* Mousetail S1	damp, calcareous, rocky places, open disturbed ground	6E(15)	√						√								
RANUNCULACEAE *Pulsatilla patens* Pasque-flower S1	exposed slopes and dry prairies	5S					√		√								
RANUNCULACEAE *Ranunculus hispidus var. hispidus* Bristly Buttercup S1	Dry, opensandy woods, savannahs	6E, 7E					√			√						√	
RANUNCULACEAE *Ranunculus hyperboreus* Arctic Buttercup S2	wet mud and shallow tundra pools	1E												√			
RANUNCULACEAE *Ranunculus pallasii* Buttercup S2	fens, marshes and lakshore meadows	1E;2E													√		
RANUNCULACEAE *Ranunculus pedatifidus* Northern Buttercup S2	moist tundra, shingle beaches and brackish lagoons	1E												√			
RANUNCULACEAE *Ranunculus reptans var. ovalis* Creeping Spearwort S1?	Wet shores											√			√		
RANUNCULACEAE *Ranunculus rhomboideus* Prairie Buttercup S3	Dry sandy open woods, savannah, prairie	5E, 6E, 7E					√		√	√						√	
RANUNCULACEAE *Thalictrum revolutum* Waxy Meadow-rue S2	rich alluvial woods, marsh edges and mossy creek beds	7E(1,2,3,5)													√	√	
ROSACEAE *Agrimonia parviflora* Swamp Agrimony S3S4	woods, fields prairies	7E(1,2,3,5)					√									√	
ROSACEAE *Amelanchier amabalis* Juneberry S2S3	Open rocky or sandy woods and edges	6E, 7E														√	√
ROSACEAE *Crataegus apiomorpha* Hawthorn S1S2	NO INFORMATION																
ROSACEAE *Crataegus ater* Hawthorn S1?	NO INFORMATION																
ROSACEAE *Crataegus brainerdii* Hawthorn S2	old fields, poorly managed pastures, fencelines and roadsides	6E(6,9,12,15); 7E(2,3,6)															
ROSACEAE *Crataegus compta* Hawthorn S2?	NO INFORMATION																
ROSACEAE *Crataegus conspecta* Hawthorn S1	old fields, poorly managed pastures, fencelines and roadsides	7E(3,4,5)															
ROSACEAE *Crataegus corusca* Hawthorn S2S3	old fields, poorly managed pastures, fencelines and roadsides	6E;7E(2)															
ROSACEAE *Crataegus dilatata* Hawthorn S1	NO INFORMATION																

Family Family Name^1 **Scientific Name** **Common Name** **NHIC ranking**	**Habitat Description^2**	**Site Region^3 (Site District)**	**Alvars**	**Aquatic**	**Cliffs**	**Dunes (sand)**	**Prairies/Grasslands**	**Riparian**	**Rock Outcroppings**	**Savannahs**	**Seeps**	**Shorelines**	**Talus Slopes**	**Tundra**	**Wetlands**	**Woodlands**	**Woodland Edge**
ROSACEAE *Crataegus disperma* Hawthorn S1?	Scrubby alvar	7E(1)	√														√
ROSACEAE *Crataegus dissona* Hawthorn S3	old fields, poorly managed pastures, fencelines and roadsides	7E(2,3,4,5,6)															
ROSACEAE *Crataegus formosa* Hawthorn S2	old fields, poorly managed pastures, fencelines and roadsides	7E(3,5)															
ROSACEAE *Crataegus fullerana* Hawthorn S2?	Taxonomic problem;obscure																
ROSACEAE *Crataegus grandis* Grand Hawthorn S1?	NO INFORMATION																
ROSACEAE *Crataegus perjucunda* Hawthorn S1?	old fields, poorly managed pastures, fencelines and roadsides	7E(2,6)															
ROSACEAE *Crataegus persimilis* Hawthorn S1	NC INFORMATION																
ROSACEAE *Crataegus scabrida* Hawthorn S3?	taxonomic problem;obscure																
ROSACEAE *Crataegus suborbiculata* Hawthorn S1	old fields, poorly managed pastures, fencelines and roadsides	6E(4,14);7E(2,6)															
ROSACEAE *Dryas drummondii* Yellow Dryas S1	rock crevices	3W															
ROSACEAE *Geum vernum* Spring Avens S3	deciduous woods and alvars	7E(1,5)	√					√								√	
ROSACEAE *Geum virginianum* Pale Avens S1	Rocky woods	7E(1)														√	
ROSACEAE *Potentilla gracilis* Cinquefoil S2	stoney shorelines, clayey to sandy meadows and old fields	2W,3W,4W										√					
ROSACEAE *Potentilla hippiana* Cinquefoil S1	lakeshore meadows, rocky beaches and old fields	4W										√					
ROSACEAE *Potentilla multifida* Cinquefoil S2	sandy to rocky soil on roadsides and shorelines	1E;2W;3W;4W										√					
ROSACEAE *Potentilla nivea* Cinquefoil S2	cliffs	1E;4W			√												
ROSACEAE *Potentilla paradoxa* Bushy Cinquefoil S3	sandy shorelines	5S;6E(7,13,15); 7E(1,2,3)										√			√		
ROSACEAE *Potentilla pulchella* Cinquefoil S2	sand and gravel beach ridges	1E										√					
ROSACEAE *Prunus pumila var. besseyi* Bessey's Plum S1	Dry, open sandy or rocky ground	5S, 6E					√		√								
ROSACEAE *Rosa setigera*^{V} Prairie Rose S3	open woods and thickets	7E(1)	√				√									√	√
RUBIACEAE *Galium brevipes* Short-stalked Bedstraw S2?	Moist, open shores	5E										√			√		
RUBIACEAE *Galium concinnum* Shining Bedstraw S1	woods	7E														√	
RUBIACEAE *Galium kamtschaticum* Boreal Bedstraw S2	cool, moist woods, thickets and valleys	4E														√	
RUBIACEAE *Galium pilosum* Hairy Bedstraw S3	dry, sandy woods and thickets; occasionally in dry sandy fields	6E(5,10);7E(1,2,3,4,5)					√			√						√	
RUBIACEAE *Hedyotis caerulea* Bluets S1	moist, open or partly shaded, sandy areas	5E(10);6E(1,5,6)															
RUPPIACEAE *Ruppia maritima* Ditch-grass S2	saline waters of coastal marsh pools and intertidal flats	2E		√								√			√		
RUTACEAE *Ptelea trifoliata*^{V} Hop Tree S3	shorelines and other dry sites	7E(1,2,5)	√			√						√					√

Family¹ Family Name¹ Scientific Name Common Name NHIC ranking	Habitat Description³	Site Region² (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
SALICACEAE *Salix arbusculoides* Willow S1	calcareous clay-silts of riparian littoral zone	1E						√									
SALICACEAE *Salix arctica* Arctic Willow S3	beach ridges, dry hillsides and wet sand	1E										√					
SALICACEAE *Salix lutea* Willow S2	NO INFORMATION																
SALICACEAE *Salix maccalliana* McCalla's Willow S3	widespread or common																
SALICACEAE *Salix myricoides var. albovestita* Shoreline Willow S2?	NO INFORMATION																
SALICACEAE *Salix myricoides var. myricoides* Blue-leaf Willow S2S3	Dunes	6E				√											
SALICACEAE *Salix pseudomonticola* False Mountain Willow S3	NO INFORMATION																
SAURURACEAE *Saururus cernuus* Lizard's Tail S3	shores and shallow water	6E(12,15); 7E						√				√			√		
SAXIFRAGACEAE *Chrysosplenium tetrandrum* Northern Golden-carpet S3?	NO INFORMATION																
SAXIFRAGACEAE *Heuchera americana* Rock-geranium S2	wet to moist woods and thickets	7E(1)	√													√	
SAXIFRAGACEAE *Parnassia kotzebuei* Kotzebue's Grass-of-parnassus S2S3	riparian willow thickets and moss-covered or ericaceous, moist tundra heath	1E												√			
SAXIFRAGACEAE *Saxifraga cespitosa* Tufted Saxifrage S2	wet and dry areas in beach ridge complexes	1E										√					
SAXIFRAGACEAE *Saxifraga oppositifolia* Purple Mountain Saxifrage S1	tundra barrens, disturbed gravel habitats along roads and aircraft landing strips	1E												√			
SAXIFRAGACEAE *Saxifraga pensylvanica* Swamp Saxifrage S1	spruce bogs, cedar bogs, boggy meadows	5S													√		
SCROPHULARIACEAE *Agalinis gattingeri*[E] Round-stemmed Purple False Foxglove S1	meadows and dry, open ground, alvars	5E, 6E, 7E(1,6)	√				√										
SCROPHULARIACEAE *Agalinis purpurea* Large Purple False Foxglove S1	prairies	7E					√										
SCROPHULARIACEAE *Agalinis skinneriana*[E] Pale Purple False Foxglove S2	prairies and dry, open ground	7E(1)					√										
SCROPHULARIACEAE *Aureolaria flava* Smooth Yellow False Foxglove S3	Open oak woods	7E					√			√						√	
SCROPHULARIACEAE *Aureolaria pedicularia* Fernleaf Yellow False Foxglove S3	dry, open pine and oak woods and thickets; often on sand and along disturbed woodland margins; hosts frequently include woody species other than pines and oaks	7E					√			√						√	√
SCROPHULARIACEAE *Aureolaria virginica* Downy Yellow False Foxglove S1	dry, open, deciduous woods	7E(2,3)														√	
SCROPHULARIACEAE *Buchnera americana*[T] Bluehearts S1	wet dune slacks, moist sandy meadows and damp, sandy soil between sparsely wooded sand dunes	7E(2)				√									√		
SCROPHULARIACEAE *Collinsia parviflora* Small-flowered Blue-eyed Mary S2	thin soil over acidic bedrock	5E(1,7);6E(6,15)			√				√				√				
SCROPHULARIACEAE *Euphrasia vinacea* Eyebright S1?	taxonomic problem; obscure																
SCROPHULARIACEAE *Leucospora multifida* Leucospora S1	open grasslands, damp sand or gravel and seams in limestone pavement	7E(1)	√				√					√					
SCROPHULARIACEAE *Limosella aquatica* Mudwort S2	lagoons, sandy shores and exposed clay flats	1E;2E;4S										√			√		
SCROPHULARIACEAE *Linaria canadensis* Blue Toadflax S1	disturbed peaty ground and cultivated fields; weedy	7E(2,5)															
SCROPHULARIACEAE *Lindernia dubia var. anagallidea* Slender False Pimpernel S1	Moist shores	5E(11)										√			√		

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[2]	Site Region[3] (Site District)	Alvars	Aquatic	Cliffs	Dunes (sand)	Prairies/Grasslands	Riparian	Rock Outcroppings	Savannahs	Seeps	Shorelines	Talus Slopes	Tundra	Wetlands	Woodlands	Woodland Edges
SCROPHULARIACEAE *Mimulus alatus* Winged Monkey Flower S2	wet deciduous woods and stream banks	7E(1,5)						√							√	√	
SCROPHULARIACEAE *Mimulus moschatus* Muskflower S2?	seepages	6E									√				√		
SCROPHULARIACEAE *Penstemon gracilis* Slender Beard-tongue S1	dry open woods, prairies and open rocky slopes	5S					√		√							√	
SCROPHULARIACEAE *Rhinanthus minor ssp. groenlandicus* Yellow Rattle S3																	
SCROPHULARIACEAE *Veronicastrum virginicum* Culver's-root S2	damp prairies and meadows, open, moist deciduous woods	7E(1,2)					√									√	
SELAGINELLACEAE *Selaginella densa* Prairie Spikemoss S2	dominant on dry, eroding, grassy knolls and granitic slopes in *Cladina* (lichen) beds in open, medium-aged jack pine forests	3S;4S, 4W; 5S					√		√							√	
SMILACACEAE *Smilax ecirrhata* Upright Carrion Flower S3?	Rich woods	7E														√	
SMILACACEAE *Smilax illinoensis* Illinois Carrion Flower S2?	Rich woods	7E														√	
SMILACACEAE *Smilax rotundifolia*[T,V] Common Greenbrier S2	moist to dry woods or thickets	7E(1)														√	
SOLANACEAE *Leucophysalis grandiflora* Large-flowered Ground-cherry S3?	sandy or rocky open areas	4W, 5E, 6E					√		√								
SPARGANIACEAE *Sparganium androcladum* Branching Bur-reed S1	shallow water and muddy shores of ponds, lake margins and marshes	6E(5,8,9,11,12); 7E(5,6)										√			√		
SPARGANIACEAE *Sparganium hyperboreum* Northern Bur-reed S2?	wetlands														√		
SPARGANIACEAE *Sparganium multipedunculatum* Many-stalked Burweed S1	shallow water of ponds, lake edges and quiet stream shores	3W;4W		√								√			√		
THELYPTERIDACEAE (ASPLENIACEAE) *Phegopteris hexagonoptera*[V] Broad Beech Fern S3	rich, moist soil in mature deciduous forests	6E(9,10,11);7E														√	
THELYPTERIDACEAE (ASPLENIACEAE) *Thelypteris simulata* Bog Fern S1	densely shaded, red maple bog-fringe forest, with herb layer dominated by cinnamon fern (*Osmunda cinnamomea*)	6E(12)													√	√	
ULMACEAE *Celtis tenuifolia*[V] Dwarf Hackberry S2	open, sandy woods	6E(15);7E(1,2)				√				√						√	
VALERIANACEAE *Valeriana edulis* Hairy Valerian S1	swampy river flats and meadows; wet prairies; wooded, rocky riverbanks	6E(2);7E(2,6)					√	√							√		
VALERIANACEAE *Valeriana sitchensis* Marsh Valerian S2	calcareous sphagnum bogs, marshy meadows, cedar-tamarack-spruce swamps, wet,open fens and wet woods	6E(1,5,6,7,8,9); 7E(2,6)													√		
VALERIANACEAE *Valerianella umbilicata* Northern Corn-salad S1	open *Rhus-Cornus-Crataegus* thickets on limestone plains	7E(1,2)	√					√									
VERBENACEAE *Phyla lanceolata* Fog Fruit S2	roadside ditches and wet places	7E(1,2)						√				√			√		
VIOLACEAE *Hybanthus concolor* Green Violet S2	rich, wet-mesic floodplain forests and mesic forests over limestone	6E(1,2,5); 7E(2,3,5,6)						√								√	
VIOLACEAE *Viola epipsila* Northern Marsh Violet S3	Moist woods															√	
VIOLACEAE *Viola novae-angliae* New England Violet S2S3	Rocky woods	3W, 4W							√							√	
VIOLACEAE *Viola palmata var. dilatata* Cleft Violet S2	dry-mesic or sometimes wet-mesic sandy loam forests, disturbed forests and prairie- forest ecotones	Regional Mun. of Haldimand-Norfolk														√	
VIOLACEAE *Viola palmata var. palmata* Palmate Violet S2	dry-mesic or sometimes wet-mesic sandy loam forests, disturbed forests and prairie- forest ecotones	7E(1,2,5,6)						√								√	
VIOLACEAE *Viola pedata*[T] Bird's-foot Violet S1	open, dry oak and jack pine woods , sand barrens, dry prairies and dune forests	7E(2,3,5)				√	√			√						√	
VIOLACEAE *Viola pedatifida* Prairie Violet S1	Dry open woods	7E														√	

Family Family Name[1] Scientific Name Common Name NHIC ranking	Habitat Description[3]	Site Region[2] (Site District)	Alvars	Aquatic	Cliffs	D unes (sand)	Prairi es/Grasslands	Riparian	Rock Outcroppings	S avannahs	Seeps	S horelines	T alus Slopes	Tundra	Wetlands	V Voodlands	Wo odland Edges
VIOLACEAE *Viola rafinesquii* Wild Pansy S1	dry, oak-hackberry-blue ash savannah over limestone in Ontario	7E(1)								√							
VIOLACEAE *Viola rotundifolia* Round-leaved Yellow Violet S1	rich, mesic maple-birch-hemlock forests	6E(10);7E(2,3,5)														√	
VIOLACEAE *Viola striata* Cream Violet S3	rich, floodplain forests and low,wet woods	6E(1);7E(1,2,6)						√								√	
VITACEAE *Vitis labrusca* Northern Fox Grape S1	woods	7E														√	
VITACEAE *Vitis vulpina* Frost Grape S1	floodplain woods	7E(1)						√								√	
XYRIDACEAE *Xyris difformis* Tall Yellow-eyed-grass S3?	gravelly or sandy shorelines, moist open areas, bogs and depressions	5E(7,8);6E(6)										√			√		
ZOSTERACEAE *Zostera marina* Eel-grass S2	intertidal mudflats	2E			√							√			√		

[1] Source: Ministry of Natural Resources Natural Heritage Information Centre: List of Ontario Rare Vascular Plants (Revised March 1997)

[2] Source: Argus, G.W., K. M. Pryer, D.J. White and C. J. Keddy [eds]. 1987. Atlas of the rare vascular plants of Ontario. 4 Parts. National Museum of Natural Sciences, National Museum of Canada.

[3] Source: Don Cuddy (Personal Communication 1999) Southern Science Technology Transfer Unit, Kemptville

APPENDIX H

Suggested Terms of Reference for the Formation and Operation of a Conservation Advisory Committee (CAC)

The following suggestions for the formation and operation of a Conservation Advisory Committee are based largely on the experience and approach developed and used by the Regional Municipality of Waterloo to revise the Waterloo Region's Significant Species List: Breeding Birds Component.

- Clearly stated objectives will help to guide the actions of the CAC and will keep it focused on the most important tasks.

- Initial selection of tasks for the CAC should emphasize the strengths of the panel of experts. Staff at the Regional Municipality of Waterloo began with the Bird Component of the Region's Significant Species List because birds are better known than other groups of wildlife, there is a broader base of available expertise, and the list of birds is of a manageable length. The examination of reptiles and amphibians species and their respective habitats might also provide a starting point because there are few species in the province and many of them are found in wetland habitats.

- Invite the most knowledgeable experts to a series of evening meetings. The participants might represent a broad spectrum of backgrounds and interests: consultants; OMNR, CWS and other government agency staff; university professors; municipal staff or council members; and local naturalists.

- Prospective members need not live in the municipality. However they must be familiar with the flora and fauna in the planning area. Awareness of the important ecological considerations involved in the identification, evaluation, and protection of natural heritage features and areas would an important asset. CAC candidates should be willing to work with other members towards the development of a natural heritage system for the municipality. However they must realize that their primary role is to assist the planning authority with decisions concerning the conservation of important areas within the municipality.

- Include in the invitation, an explanation of the proposed objectives of the CAC, a description of the specific tasks to be undertaken by committee members, any pertinent information related to these specific tasks (e.g., list of bird species, written reports), a polite request that the recipient review the enclosed information, an explanation about why the recipient has received an invitation and the need for his or her involvement, an agenda, location, and schedule of meetings, and a request that the recipient call by a certain date to indicate a willingness to attend, or send written comments.

- Informal, informative presentations at the first meeting (and subsequent meetings if desired) can provide participants with the necessary background information, and a sense of the current situation (e.g., existing information, knowledge gaps, priorities) as well as set the stage for future involvement by them.

- As early as possible, try to agree by consensus on the approaches that will be used to work on the specific tasks before the CAC. Sometimes this may require some facilitation.

- Encourage feedback from participants by making time available for discussion and remaining flexible.

- To keep the process moving, provide "homework" for committee members during interludes between meetings. This might include research, reading, revision of lists and data sources, or site visits.

Prior to adoption of CAC recommendations, encourage public awareness and participation in CAC decisions through advertised information sessions. Occasional newsletters might help to inform local residents and provide opportunities for comments.

APPENDIX I

Information Sources for the Identification of Significant Wildlife Habitats

Table I-1: Information Sources for the Identification of Seasonal Concentrations of Animals

Seasonal Concentrations of Animals	Information Sources and Information Provided
Mammals	
Winter deer yards	• OMNR for location and relative importance of many yards; deer habitat requirements • OMNR publications • Broadfoot & Voigt (1996) suggested how and when to measure deer yard size • Ranta (1998) outlines how to conduct aerial surveys of deer yards
Bat winter hibernacula and maternity colonies	• OMNR for possible locations of hibernacula; a source for contact with bat experts • Ontario Ministry of Northern Development and Mines for locations of abandoned mines that may provide potentially significant bat hibernacula • some members of outdoor recreation clubs (e.g., Sierra Club) explore caves and may know location of hibernacula • little available information on location of bat hibernacula • University Biology Departments for bat experts who may know locations of important sites & habitat requirements • other sources including consultant and naturalist club reports, atlas results etc. may provide some site-specific information for some of the species. They may be found at OMNR, NHIC, Conservation Authority, OMOT, Ontario Hydro, municipality offices
Moose winter habitat	OMNR for possible locations of some sites; moose habitat requirements
Birds	
Colonial bird nesting sites including colonies of herons, gulls and terns, swallows	• OMNR for location and size of some heronries, gull and tern colonies • some information regarding location and size of heronries, gull and tern colonies may be out-dated and in need of verification since some inventories were done during the 1970s and 1980s • CWS for location and size of some gull, tern, cormorant colonies on Great Lakes • OMNR wetland evaluations identify colonial nest sites (e.g., Black Terns, heronries) if they were observed at time of wetland evaluation • OMNR publications • Bowman & Siderius (1984) guidelines for heronry protection • Bird Studies Canada (LPBO) for location and size of some heronries • Ontario Birds at Risk Program (OBAR); Bird Studies Canada (LPBO) volunteers monitor known breeding sites of rare species and survey for new breeding sites; some colonial species (e.g., Black Tern) are on this list • Ontario Nest Records Scheme (ONRS); ROM database provides information on breeding distribution, nest locations for 283 species • local birders for location of some local colonies

Seasonal Concentrations of Animals	**Information Sources and Information Provided**
Waterfowl nesting, staging, migration stopover areas	• OMNR for location of regionally and locally significant sites • Hickie (1985) – Habitat management guidelines for waterfowl in Ontario. • OMNR Wetland Evaluations identify locally significant areas • Canadian Wildlife Service for location of regionally and provincially significant sites; species habitat requirements; species of conservation concern; source of several potentially helpful publications • Ontario Nest Records Scheme (ONRS); ROM database provides information on breeding distribution, nest locations for 283 species • Ducks Unlimited Canada for location of important local sites; species habitat requirements; restoration of waterfowl nesting habitat • local birders for location of some locally important areas; location of some nesting species of conservation concern
Forested sites with concentrations of nesting birds	• Canadian Wildlife Service, Guelph for locations of and data on their Forest Bird Monitoring Program sites; may also provide contact with local Program volunteers who know locations of sites with high density and diversity of breeding and/or migrant birds. • OMNR/Bird Studies Canada (LPBO) for location of some sites with several raptor nests (e.g., Ospreys) • Ontario Nest Records Scheme (ONRS); ROM database provides information on breeding distribution, nest locations for 283 species • local birders for location of some locally significant sites
Migration stopover areas for landbirds, shorebirds	• Canadian Wildlife Service; Bird Studies Canada; Federation of Ontario Naturalists for location of provincially and regionally significant sites • CWS, Downsview for contact with volunteers involved in Ontario Shorebird Survey; these people may know locally significant sites for shorebirds • local birders for location of some locally significant sites and names of local birding guidebooks that describe location of hotspots for migratory birds
Raptor (hawks, eagles, owls, falcons) Winter roosting & feeding areas	• OMNR; local birders and area farmers for location of some significant areas (little available information)
Wild Turkey winter roosting and feeding areas	• OMNR; local birders and area farmers for location of some significant areas (little available information) • OMNR publication: ⇒ Reid (1991) OMNR habitat requirements of Wild Turkeys • local residents and birders for location of some sites
Turkey Vulture summer roosting areas	• local residents and birders for location of some sites (little available information) • other sources including consultant and naturalist club reports, atlas results etc. may provide some site-specific information for some of the bird species listed in this table. They may be found at OMNR, NHIC, Conservation Authority, OMOT, Ontario Hydro, and municipality offices.

Seasonal Concentrations of Animals	**Information Sources and Information Provided**
Reptiles and Amphibians	
	• OMNR offices for general location of some important habitats; location of a few bullfrog concentration areas; species habitat requirements; a source of contact with experts • NHIC in Peterborough maintains database on location of reptiles and amphibians & includes location of known concentration areas; contact through local OMNR Ecologist • Canadian Wildlife Service, Burlington for contact with volunteers participating in Amphibian Road Call Counts who know locally important sites • Long Point Bird Observatory for contact with local volunteers participating in Marsh Monitoring Program and the Backyard Amphibian Survey, who know locally important sites • Royal Ontario Museum and Canadian Museum of Nature data have been incorporated into the NHIC database • other sources including consultant and naturalist club reports, atlas results etc. may provide some important site locations and species descriptions. They may be found at OMNR, NHIC, Conservation Authority, OMOT, Ontario Hydro, municipality offices
Butterfly Migratory Stopover Areas (little available information)	
	• OMNR; Agriculture Canada (Ottawa) are possible sources for contact with local experts and location of locally and regionally significant sites • University Biology Departments for contact with authorities who may know locally important sites • Holmes et al. 1991. *The Ontario Butterfly Atlas*. Toronto: Toronto Entomologists' Association for general information on distribution, habitat, food requirements but no site-specific information. This may be found at the NHIC in Peterborough, FON in Toronto, and various other bookstores • Toronto Entomologists' Association (contact Royal Ontario Museum) for members who may know location of some locally significant sites • local naturalists may know location of locally significant sites • other sources including consultant and naturalist club reports, atlas results etc. may provide some important site locations and species descriptions. They may be found at OMNR, NHIC, Conservation Authority, OMOT, Ontario Hydro, municipality offices

Table I-2: Information sources for the identification of rare vegetation communities or specialized wildlife habitats

Rare Vegetation Community	**Information Sources and Information Provided**
wetland communities	• OMNR Ecologists can provide lists of plant species that are indicators of fen and bog wetlands. • OMNR publication: ⇒ Bakowsky (1996) *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario* describes natural communities by dominant plant species, and physical characteristics of the site such as soil depth and moisture regime and rare wetland community types are identified. • OMNR Wetland Evaluations Class 1-7 differentiate more uncommon wetland type e.g., fens, bogs that often support of rare vegetation communities; many provide common plant species lists; some rare plants are recorded for some wetlands; include map illustrating dominant plant communities; mention other scientific studies, reports related to the wetland. • Ontario Geological Survey Peat and Peatland Evaluation reports also describe and map these communities. • OMNR ANSI Site District Reports describe vegetation composition (species observed) of candidate areas; may briefly describe other potentially locally or regionally significant wetlands that have been identified but were not closely examined for ANSI status; provide complete site descriptions and maps of ANSIs and candidate ANSIs. • Topographical maps (scale 1:50,000) can help to locate wetlands, provide fairly specific location & approximate size of identified wetland communities. • Aerial photographs (scale 1:10,000) can help to locate wetlands, especially helpful finding smaller wetlands; can help to determine whether marsh or swamp and location of wetland relative to upland communities; essential in mapping location and extent of vegetation communities; some unique communities can be identified depending on photo interpretative skill. • Local naturalists may know locations of locally significant communities. • OMNR NW Ontario Wetland Classification (Racey and Harris 1995) describes procedures for differentiating wetland communities at a hierarchy of scales; locations of some rare wetland community types in northwestern Ontario are provided. • Consultant and naturalist club reports may provide descriptions of significant wetland vegetation communities found in local wetlands. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices. • Parks Canada produced a report on all of the wetlands on the Rideau Canal system; contact Parks Canada, Smiths Falls or OMNR. • Federation of Ontario Naturalists (FON) produced a report on some of the wetlands of Ontario. • University, museum, and provincial/national park herbaria collections include rare plant species, name of collector and date of collection, approximate location where plants were collected.

Rare Vegetation Community	**Information Sources and Information Provided**
prairies, alvars, savannahs; rock barrens; sand barrens	• OMNR Ecologists can obtain maps of these rare plant communities from the NHIC in Peterborough and can provide lists of plant species that are indicators of prairies, alvars, savannahs. • OMNR and NHIC publication: ⇒ Bakowsky (1996) *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario* describes plant communities by dominant plant species, and physical characteristics of the site such as soil depth and moisture regime; comprehensive listing of rare plant communities found in southern Ontario. • OMNR ANSI Site District Reports provide detailed descriptions (plant species and communities) of several of these rare communities as well as site maps. • Some researchers have examined these communities in Ontario describing physical characteristics, and plant species composition. They also have included precise locations of sites (e.g., Catling and Catling (1993)- limestone savannah, prairie, sand barren; Catling and Brownell (1995)- alvars; Bakowsy (1993) - prairie, savannah. These studies can be obtained from the OMNR Ecologist. • Local naturalists may know locations of locally significant communities. • Consultant and naturalist club reports may provide some site-specific information about locally significant areas. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices. They may also be found in scientific journals and publications such as *The Canadian Field-Naturalist.* • University, museum, and provincial/national park herbaria collections include rare plant species, name of collector and date of collection, approximate location where plants were collected. Indicator plants of these rare communities found in these collections may help to locate specific sites. • County soil survey reports and maps describe local physical characteristics such as landforms, drainage patterns, soils, and moisture regimes that can narrow search for rare communities such as alvars (e.g., indicate areas with deep sand deposits, little mineral soil).
forest stands with rare tree associations and/or rare tree species **See Appendix L for a list of rare forest communities found in S. Ontario**	• OMNR Foresters often know the location of forest stands containing rare tree species. • OMNR publication: ⇒ Bakowsky (1996) *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario* describes these communities by dominant plant species, and physical characteristics of the site such as soil depth and moisture regime; lists and briefly describes rare forest communities of southern Ontario. • OMNR ANSI Site District Reports provide detailed descriptions (plant species and communities) of candidate ANSI sites that may contain rare forest types as well as site maps. • OMNR Forest Resource Inventory (FRI) maps (scale 1:15,840) indicate the dominant tree species, percent composition of the stand, and approximate age of the forest stands; initially helpful in locating potentially rare forest types for the municipality; but only indicate species comprising at least 10% of the mapped stand. • Local naturalists may know locations of locally significant communities. • Aerial photographs (scale 1:10,000) can help to locate woodlands, provide rough estimate of woodland area, and are essential in mapping location and extent of vegetation communities; can also locate help to locate older woodlands. • Topographical maps (scale 1: 50,000) can help to locate woodlands, provide fairly specific location and approximate size of identified communities; they should be used in conjunction with Forest Resource Inventory (FRI) maps and aerial photographs. • OMNR Forest Ecosystem Classifications for NW Ontario (Sims et al. 1989); NE Ontario (Taylor et al. 2000); Central Ontario (Chambers et al. 1997); Southern Ontario (Lee et al. 1998) provide detailed descriptions of natural forest types of these regions; some information on the

Rare Vegetation Community	**Information Sources and Information Provided**
	distribution of species. Database for S. Ontario (contact H. Lee, OMNR London office). Municipalities can use the information to classify their own forests and determine the representation of forest types in the area; forest types should be mapped at similar scale to aerial photograph interpretations (i.e., 1:10,000). • OMNR Growth and Yield Program have established research plots in some woodlands with locally or regionally rare trees and tree associations. • Ontario Tree Atlas is being coordinated by the University of Guelph. Contact staff at the Arboretum; they can provide contact with local volunteers who may know locations of woodlands containing rare trees and tree associations. • University, museum, and provincial/national park herbaria collections include rare plant species, name of collector and date of collection, approximate location where plants were collected. Indicator plants of these rare communities found in these collections may help to locate specific sites. • County soil survey reports and maps describe local physical characteristics such as landforms, drainage patterns, soils, and moisture regimes that can narrow search for rare forest associations. • Consultant and naturalist club reports may provide some site-specific information about locally significant woodlands with rare trees and tree associations. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices. They may also be found in scientific journals and publications such as *The Canadian Field- Naturalist*.
cliffs/talus slopes; Great Lakes dunes; beach shorelines; grasslands *etc.*	• OMNR Ecologists may know the location of some of these rare communities. • OMNR publication: ⇒ Bakowsky (1996) *Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario* describes these communities by dominant plant species, and physical characteristics of the site such as soil depth and moisture regime; these rare communities are listed and briefly described. • OMNR ANSI Site District Reports provide detailed descriptions (plant species and communities) of some of the candidate ANSI sites, and include site maps. • Local naturalists may know locations of locally significant communities. • Aerial photographs used in conjunction with topographical maps can help to verify presence of these communities. • Topographical maps indicate areas of sharp relief, shorelines, and potential grassland areas. • County soil survey reports and maps describe local physical characteristics such as landforms, drainage patterns, soils, and moisture regimes that can narrow search for these communities (e.g., indicate areas with deep sand deposits). Consultant and naturalist club reports may provide some site-specific information about these communities. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices. They may also be found in scientific journals and publications such as *The Canadian Field-Naturalist*.

Specialized Wildlife Habitats	**Information Sources and Information Provided**
habitat supporting area-sensitive birds (e.g., hawks, songbirds)	• OMNR Ecologists may know the location of sites supporting area-sensitive species. • Topographical maps and aerial photographs can help to locate existing forest stands, grasslands; aerial photographs especially helpful for finding areas of greatest amount of contiguous closed-canopy forest cover required by forest species • OMNR Forest Resource Inventory (FRI) maps (scale 1:15,840) indicate dominant tree species, percent composition of the stand, and approximate age of the forest stands; latter information particularly helpful in locating potentially significant forest habitats for these species because older deciduous stands with abundant and diverse forest structure tend to be preferred. Most effectively used in conjunction with aerial photographs and topographical maps. • Ontario Hydro has produced regional forest cover maps for southern Ontario that provide an indication of percent forest cover for each mapped area; they could be used to identify sites with greatest potential to support these species. • Local birders may know location of premier woodlands for area-sensitive species, the location of some forest nesting raptors, and premier grassland sites. • Canadian Wildlife Service, Guelph, for locations of and data on their Forest Bird Monitoring Program sites; may also provide contact with local Program volunteers who know locations of locally significant forest stands supporting these species. • OMNR Growth and Yield and Ecological Land Classification Programs (OMNR); plot information may reveal significant forest stands by providing information such as presence of old and large trees, a variety of different vegetation strata and down woody debris- forest characteristics that are attractive to these species. • OMNR/Bird Studies Canada (LPBO) Ontario Birds at Risk Program (OBAR) runs the Red-shouldered Hawk Survey; volunteers monitor many stands in southwest and central Ontario and the records of nest locations can help to locate sites important to this area-sensitive species; OBAR program also monitors forest species currently at risk and can provide some site-specific information concerning the location of these species. • OMNR ANSI Site District Reports may describe such forest and grassland habitats and include list of bird species where observed; include site maps.
forest stands providing a diversity of habitats (e.g., tree cavities, fallen logs, vertical stratification)	• OMNR Foresters may know stands with high proportion of diseased or damaged trees and therefore likely to have more snags and cavity trees. They may also know locations of stands they call "over mature". • OMNR FRI maps note age and tree species composition of forest stands- can help to locate sites with more cavity trees and snags; particularly older forests comprised of large proportion of aspen, beech, basswood, conifers. These maps can also indicate older forests that often have diverse vertical structure. Consider the date of the FRI information. • Topographical maps and aerial photographs indicate areas with steep slopes and valleys next to streams; often these areas were not logged, resulting in older trees and abundant fallen logs. The proximity of water can make these areas attractive to salamanders. • OMNR Growth and Yield Program- plot information includes sites with cavity trees and snags, diversity of vegetation layers, and abundant down woody debris. • OMNR ANSI Site District Reports- sites with a variety of recorded shrub and tree species may indicate diversity of vegetation layers; include site maps. • OMNR publications: ⇒ Gerson (1984) - management guidelines for bats and cavity trees ⇒ Keddy and Drummond (1995)- value of wildlife trees in Eastern Ontario forests ⇒ Naylor et al. (1994)- forestry management guidelines for the provision of Pileated

Specialized Wildlife Habitats	Information Sources and Information Provided
	Woodpecker habitat. • Local birders may know location of locally significant stands with these features. • University biology departments for contact with researchers with knowledge of local habitats supporting their species of interest (e.g. southern flying squirrel, Pileated Woodpecker, four-toed salamander).
woodlands supporting springtime amphibian breeding ponds	• Contact local OMNR Ecologist • Topographical maps and aerial photographs can help to locate some potential areas. • Local naturalists may know location of woodland ponds and areas with notable spring breeding choruses of frogs. • Long Point Bird Observatory for contact with local volunteers participating in Marsh Monitoring Program and Backyard Amphibian Survey • CWS (Burlington) for contact with volunteers involved with the Amphibian Road Cali Counts who know locally important sites.
foraging areas producing abundant fruit and nuts	• OMNR Foresters, Ecologists, and Conservation Officers know locations of some sites. • OMNR FRI maps will indicate forest stands with abundance of mature trees producing mast nuts (e.g., oaks, beech, hickory) • Topographical maps and aerial photographs can indicate features like ridges and rock barrens that often have oaks and berry-producing shrubs respectively. • OMNR Ecological Land Classification Programs- plot information records sites that were sampled with trees and shrubs that can produce nuts and berries; food production potential can be inferred from this information • OMNR ANSI Site District Reports describe plant communities and record shrubs and trees-food production potential can be inferred from this information; include site maps • OMNR/local fish and game and hunt clubs for contacts with local hunters (especially turkey, Ruffed Grouse, deer, bear) who may know local sites with significant concentrations of mast and berry producing vegetation. • Ontario Nut Producers Association- members are seed collectors and know where productive trees and stands are located.
moose aquatic feeding areas, mineral licks, calving areas	• OMNR for location of some important aquatic feeding areas and description of such habitats; moose habitat requirements; contact with knowledgeable people • Aerial photographs can help to identify sections of creeks and bays with high potential as aquatic feeding areas • Little available information on location of mineral licks and calving areas • OMNR publications: ⇒ OMNR (1988) for timber management guidelines for provision of moose habitat ⇒ Ranta (1998) to identify, map and rank moose aquatic feeding areas ⇒ Other references with more information about moose habitat include: Allen 1987; Bellhouse et al. 1993; Jackson et al. 1987; Naylor et al. 1992
mink and otter feeding and denning sites	These sites are difficult to find but the following sources will provide assistance: • Aerial photographs can help to locate prime areas- undisturbed shorelines with abundant vegetation and down woody debris e.g., dead falls, large logs • OMNR for contact with local trappers for information on locations of high populations • OMNR Wetland Evaluations record presence of these mammals or signs of them (tracks, scat etc.) as well as presence in other years, through interviews with local trappers. • Novak et al. (eds.) 1987. *Wild Furbearer and Conservation Management in Ontario* - available at OMNR offices

Specialized Wildlife Habitats	**Information Sources and Information Provided**
marten and fisher denning habitat	These sites are also hard to find but some may be found by referring to the following sources: • OMNR FRI maps will indicate potential woodlands containing larger, older trees that are likely to provide cavities and abundant down woody debris. • OMNR for contact with local trappers for information on areas with high populations. • Novak et al. (eds.) 1987. *Wild Furbearer and Conservation Management in Ontario* – available at OMNR offices
areas of high species and/or community diversity	• OMNR Ecologist may know location of sites with high diversity. • OMNR ANSI Site District Reports note diverse communities and include species lists and site maps. • Many OMNR Wetland Evaluations provide plant species lists and record all types of wetland communities found within a defined wetland boundary. • Local naturalists and FON members may know location of areas of high community and/or species diversity. • Aerial photographs may indicate sites with community diversity (e.g., several different wetlands, forested uplands, open fields within the same general area). • Consultant and naturalist club reports may provide some site-specific information about areas with high community diversity. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices.
old growth or mature forest	• OMNR Foresters know locations of oldest forest stands and may refer to them as "over-mature". • OMNR FRI maps indicate age of forest stands and can help to locate older forests in the municipality • OMNR ANSI Site District Reports describe some examples of older forests of provincial or regional significance; some reference may be made to older forests of local significance; include site maps • OMNR Growth and Yield and Ecological Land Classification Programs sampled plots in some stands with older trees. • Local naturalists and FON members may know location of areas of older forests in the municipality. • Consultant and naturalist club reports may provide some site-specific information about areas of old growth forest. They may be found at OMNR, OMOT, Ontario Hydro, Conservation Authority, and municipality offices.
permanent springs; seeps; cold or cool-water streams	• Topographical maps and aerial photographs indicate headwaters of streams where springs may be found. • County soil survey reports and maps describe local physical characteristics such as soils, landforms, and drainage patterns that can narrow search for springs and seeps. • Local naturalists and landowners may know of some locations. • Municipalities may have surveyed drainage systems and headwater areas may be mapped. • Many Conservation Authorities monitor stream flows and consequently may know locations of springs and seeps. • OMNR staff and local anglers may know location of some springs/seeps that can affect the distribution of sportfish such as brook trout or plants often associated with seeps (e.g., ginseng).
caves	• University faculty biologists with interest in caves or bats may know some locations. • Local naturalists, landowners, spelunkers may know location of some locations. Contact applicable clubs (e.g., Sierra Club). • Geology maps can indicate areas with certain geological features resulting in more caves (e.g., Niagara Escarpment, Upper Ottawa Valley).

Table I-3: Information Sources for the Identification of Habitats of Species of Conservation Concern

Group	Information Sources and Information Provided
Birds	OMNR Ecologists; NHIC in Peterborough • lists of candidate species of conservation concern and mapped locations of some of them • Downes and Collins. 1996. *The Canadian Breeding Bird Survey, 1966-1994.* presents bird population trends derived from annual surveys from 1966-1994; identified significant declines in some species; purpose of the program is to detect and measure year-to-year and long-term changes in breeding bird populations (also found at CWS, Bird Studies Canada) • Lepage et al. 1998. *Setting Conservation Priorities for Ontario's Breeding Landbirds-* represents the most recent effort to provide lists of landbirds of high conservation priority; the methodology is explained; report was prepared for the OMNR and is available from OMNR Ecologists and Bird Studies Canada. • Couturier. 1999. *Conservation Priorities for the Birds of Southern Ontario* reviews existing systems for setting conservation priorities; presents a suggested approach and list of species of conservation concern; includes rankings of each species based on abundance in Ontario and on the proportion of its North American breeding range/population in Canada and Canadian breeding range/population in Ontario (also found at CWS, Bird Studies Canada) • Austen et al. 1994. *Ontario Birds at Risk.* Summarized data from the Ontario Breeding Birds Atlas and Ontario Rare Breeding Bird Program to describe status, habitat requirements, and conservation needs of 58 bird species considered to be at risk (also found at Bird Studies Canada; FON) • Cadman et al. 1987. *Atlas of the Breeding Birds of Ontario.* University of Waterloo Press, Waterloo. Summary of results from atlas work by volunteers regarding breeding bird species abundance and richness observed in 10 by 10 km squares; good habitat descriptions for breeding birds of Ontario; regional coordinators and local volunteers who conducted surveys are perhaps best source of site-specific information (field work proposed for 2001 – 2005 for new updated atlas) • COSEWIC and COSSARO lists of vulnerable, threatened, endangered species in Ontario • COSEWIC status reports- present population status of species, distribution, and habitat requirements (found at CWS, Bird Studies Canada) • RENEW recovery plans for threatened and endangered species Other potential sources of information • Naturalist club publications (e.g. *Trail and Landscape* by the Ottawa Field-Naturalists' Club) • regional/local accounts such as Weir. 1989. *Birds of the Kingston Region.* • Parker et al. 1984. *Toronto Region Bird Report* possibly found at the Toronto Ornithological Club, Toronto • studies of individual species funded by OMNR, WWF, Bird Studies Canada (LPBO), universities; possibly found at OMNR; Bird Studies Canada • consultant, naturalist club, university studies may provide some additional information for specific areas/regions and may be found at OMNR; OMOT; Ontario Hydro; Conservation Authority, and municipality offices; NHIC in Peterborough • Bain and Henshaw. 1992. *Annual Bird Report, Durham Region* • journals (e.g., *The Canadian Field-Naturalist*)
Plants	OMNR Ecologists; NHIC in Peterborough • lists of some candidate species of conservation concern and mapped locations of some of them • Argus and Pryer. 1990. *Rare Vascular Plants in Canada. Our Natural Heritage.* Canadian Museum of Nature, Ottawa. • Provincially rare list of plants. This list is regularly updated by staff at the NHIC.

Group	Information Sources and Information Provided
	• Argus et al. Eds. 1982-87. *Atlas of the Rare Vascular Plants of Ontario. Parts 1-4.* National Museum of Natural Sciences, Ottawa. Provides notes on status, habitat, small-scale maps of known locations, and pertinent references for many rare plants. Includes herbaria that were consulted and names and addresses of contributors- people who may be able to provide more site-specific information. • NHIC-Peterborough has produced a draft of an annotated plant species list for Ontario that shows distribution of species by county. • Cuddy. 1991. *Vascular Plants of Eastern Ontario* lists the status of plant species that grow in Eastern Ontario by physiographic region as provincially rare, rare, and present. • Riley. 1989. *Distribution and status of the vascular plants of Central Region* lists the status of plant species that grow in Central Ontario by county as provincially rare, rare, uncommon, and common. • Oldham. 1993. *Distribution and status of the vascular plants of Southwestern Ontario* lists the status of plant species that grow in Southwestern Ontario by county as provincially rare, rare, very uncommon, uncommon, and common. • County/regional municipality vascular plant floras for the Carolinian zone of Canada. (Varga and Allen 1990) pp. 129-153. *In* Allen, G.M., P.F.J. Eagles & S.D. Price (eds.) *Conserving Carolinian Canada*, University of Waterloo Press, Waterloo. Summarizes vascular flora in 16 counties and regional municipalities in Carolinian zone of southern Ontario; notes rare species, general locations of them; names and locations of top botanical sites in each areas; names, addresses of contributors. • other county/regional flora and checklists (e.g., Gillette and White. 1978. *Checklist of Vascular Plants of the Ottawa-Hull Region* found at the National Museum of Natural Sciences, Ottawa; Morton and Venn. 1982. *A Checklist of the Flora of Ontario: Vascular Plants* found at OMNR offices and University of Waterloo • COSEWIC status reports on vulnerable species (also found at CWS) • Ontario tree atlas (in preparation) by the University of Guelph Other potential sources of information • Field Botanists of Ontario newsletter may indicate locations of some species and diverse vegetation communities; found at the NHIC in Peterborough, some OMNR offices • Naturalist club publications (e.g., *Trail and Landscape* by the Ottawa Field-Naturalists' Club) • Scientific journals and publications (e.g., *The Canadian Field-Naturalist*) • Consultant, naturalist club, and university studies may be found at OMNR; OMOT; Ontario Hydro; Conservation Authority, and municipality offices; NHIC in Peterborough
Reptiles and amphibians	OMNR Ecologists; NHIC in Peterborough • status list of all provincial species is determined and regularly updated by OMNR & NHIC staff • Weller and Oldham. 1986. *Results of Ontario Herpetofaunal Summary* provides locations of different species of reptiles and amphibians; NHIC maintains the database • COSEWIC status reports on species at risk and may also document species that are declining (also found at CWS) Canadian Wildlife Service, Burlington • for contact with local volunteers participating in Amphibian Road Call Counts who know locally important habitats for these species. Long Point Bird Observatory • for contact with volunteers participating in Marsh Monitoring Program and/or Backyard Amphibian Survey who may know locally important habitats and sites for these species. Other potential sources of information

Group	Information Sources and Information Provided
	• naturalist club publications • consultant, naturalist club, and university studies may be found at OMNR; OMOT; Ontario Hydro; Conservation Authority, and municipality offices; NHIC in Peterborough
Mammals	OMNR Ecologists; NHIC in Peterborough • status list of all provincial species is determined and regularly updated by OMNR and NHIC staff • COSEWIC status reports on vulnerable species (also found at CWS) Other potential sources of information • Dobbyn, J.S. 1994. *Atlas of the Mammals of Ontario* describes the range and distribution of mammals in Ontario; may help to determine local rarity (available from FON) • naturalist club publications • Museum of Natural Science (Ottawa) produces some publications • consultant, naturalist club, university studies may be found at OMNR; OMOT; Ontario Hydro; Conservation Authority, and municipality offices; NHIC in Peterborough • Peterson, R.L. 1966. *The Mammals of Eastern Canada*. Oxford University Press, Toronto may be found at some University libraries; OMNR offices
Butterflies	OMNR Ecologists; NHIC in Peterborough • status list of all provincial species is determined and regularly updated by NHIC and OMNR staff • Campbell, C., D.P. Coulson and A.A. Bryant 1990. Status, distribution, and life history characteristics of some butterflies at risk in the Carolinian forest zone of Ontario. pp. 207-252. *In* Allen, G.M. , P.F.J. Eagles, and S.D. Price (eds.) *Conserving Carolinian Canada*, University of Waterloo Press, Waterloo. Reports on the status of most threatened butterflies in the Carolinian zone of southern Ontario, includes general location of records; notes on distribution, habitat preferences; mentions public and private collections; recommendations for conservation. Found at the NHIC-Peterborough; some OMNR offices and university libraries. Other potential sources of information • Agriculture Canada, Ottawa, may provide contact with butterfly experts • Toronto Entomologists' Association newsletter may be found at the NHIC • naturalist club publications • Holmes et al. 1991. *The Ontario Butterfly Atlas*. Toronto: Toronto Entomologists' Association may be found at the NHIC • Layberry et al. 1998. *The Butterflies of Canada*.
Other groups	NHIC in Peterborough • Maintains a database on rare dragonflies, moths, tiger beetles, & unionid mussels • can provide contact with specialists

References

Allen, A.W. 1987. Habitat suitability index models: moose, Lake Superior region. USDI Fish and Wild. Sr., Biol. Rpt. 82(10.155) 47 p.

Argus, G.W. and K.M. Pryer. 1990. Rare vascular plants in Canada. Our natural heritage. Canadian Museum of Nature, Ottawa.

Argus,G.W., K.M. Pryer, D.J. White and C.J. Keddy. *Eds* 1982-87. Atlas of the rare vascular plants of Ontario. Part 1 – 4. National Museum of Natural Sciences, Ottawa.

Austen, M., M. Cadman and R. James. 1994. Ontario Birds at Risk. Federation of Ontario Natralists, Don Mills. 165 p.

Bakowsky, W. 1996. Natural Heritage Resources of Ontario: S-ranks for communities in site regions 6 and 7. Ontario Ministry of Natural Resources, Natural Hertiage Information Centre, Peterborough. Draft.

Bellhouse, T., B. Naylor and M. Twist. 1993. Late winter habitat selection by moose in the northern Great Lakes. Central Ontario Science and Technology Development Unit. Technical Report #25.

Bowman, I. and J. Siderius. 1984. Management guidelines for the protection of heronries in Ontario. Ontario Ministry of Natural Resources. Wildlife Branch, Toronto.

Broadfoot, J. and D. Voigt. 1996. Field inventory techniques for measuring winter deer browse supply and consumption. Ontario Ministry of Natural Resources, Research Science and Technology Branch, Technical Paper #4.

Cadman, M.D. P.F.J Eagles, F.M Helleiner. 1988. Atlas of the breeding birds of Ontario. University of Waterloo Press, Waterloo, Ontario. 617 p.

Campbell, C., D.P. Coulson and A.A. Bryant 1990. Status, distribution, and life history characteristics of some butterflies at risk in the Carolinian forest zone of Ontario. pp. 207-252. ***In*** Allen, G.M. , P.F.J. Eagles, and S.D. Price (eds.) Conserving Carolinian Canada, University of Waterloo Press, Waterloo

Catling, P.M. and V.R. Brownell. 1995. A review of the alvars of the Great Lakes region. Distribution, floristic composition, biogeography and protection. Can. Field-Naturalist. 109: 143-171

Catling, P.M. and V.R. Catling 1993. Floristic composition, phytogeography, and relationships of prairies, savannas, and sand barrens along the Trent River, eastern Ontario. Canadian Field Naturalist 107:24-45.

Chambers, B., B.J. Naylor, J. Nieppola, B. Merchant, and P.Uhlig. 1997. Field Guide to Forest Ecosystems of Central Ontario. Ontario Ministry of Natural Resources, SCSS Field Guide FG-01. 200 p.

Couturier, A. 1999. Conservation priorities for the birds of Southern Ontario. Brids Studies Canada, Port Rowan, Ontario.

Cuddy, D.G. 1991. Vascular plants of Eastern Ontario. Draft 2.0. Ontario Ministry of Natural Resources, Kemptville, Ontario. 80 p.

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Field Naturalist, Don Mills. 120 p.

Downes, C.M. and B.T. Collins. 1996. The Canadian Breeding Bird Survey,1966-1994. Canadian Wildlife Service Progress Note No. 210. Ottawa,Ontario: Environment Canada.

Gerson,H.1984. Habitat management guidelines for bats of Ontario. Ontario Ministry of Natural Resources, Wildlife Branch, Toronto, Ontario.

Gillette and White. 1978. Chekclist of vascular plants of the Ottawa-Hull Region, National Museum of Natural Science, Ottawa.

Hickie, J. 1985. Habitat management guidelines for waterfowl in Ontario. Ontario Ministry of Natural Resources, Wildlife Branch, Toronto.

Holmes, A.M., Q.F. Hess, R.R. Tasker and A.J. Hanks.1991. The Ontario Butterfly Atlas, Toronto, Ontario. 167 p.

Jackson, G.L., G.D. Racey, J.G. McNicol and L.A. Godwin, 1991. Moose habitat interpretation in Ontario. Ontario Ministry of Natural Resources, NWOFTDU Tech. Rep. 52, 74 p.

Keddy, P. and C. Drummond, 1995. Economic properties for the evaluation of eastern Ontario ecosystems. Eastern Ontario Model Forest, Kemptville, Ontario. Information report no. 13. 27p.

Layberry, R.A., P.W. Hall and J.D. Lafontaine 1988. The butterflies of Canada. University of Toronto Press, Toronto, Canada. 280 p.

Lepage, D., Bradstreet, M. and A. Couturier. 1998. Setting Conservation Priorities for Ontario's Breeding Landbirds. Unpubl. Rept. from Bird Studies Canada to Ontario Ministry of Natural Resources. Port Rowan, Ontario. 56 pp.

Lee, H., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario First approximation and its application. Ontario Ministry of Natural Resource, Southcentral Sciences Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Morton, J.K. and J.M. Venn 1990. A checklist of the flora of Ontario. University of Waterloo, Biology Series Number 34, 218 p.

Naylor, B.J., J.A. Baker, D.M. Hogg, J.G. McNicol and W.R. Watt. 1996. Forest management guidelines for the provision of Pileated Woodpecker Habitat. Ontario Ministry of Natural Resources, Queen's Printer, Sault. Ste. Marie. 26 p.

Naylor, B., S. Christilaw and P. Weilandt. 1992. Validation of a habitat suitability index model for moose in the northern portion of the Great Lakes- St. Lawrence Forest region of Ontario. Central Ontario Forest Technology Development Unit. Technical Report 26.

Novak, M. J.A. Baker, M.E. Obbard and B. Mallock.1987. Wild furbearer management and conservation in North America. Ontatio Ministry of Natural Resources. Queen's Printer. Toronto, Ontario. 1150 p.

Oldham, M.J. 1993. Distribution and status of the vascular plants in southwestern Ontario. Ontario Ministry of Natural Resources, Alymer, Ontario.

Ontario Ministry of Natural Resources. 1988. Timber management guidelines for the provision of moose habitat. Queen's Printers, Toronto. 33 p.

F4

Parker, B. D., H. Currie, D. V. Weseloh, G. Coady, A. Jaramillo and K. Konze. 1985. Toronto Region Bird Report 1984. Toronto Ornithological Club, Toronto, On., 68 p.

Peterson, R.L. 1966. The Mammals of Eastern Canada. Oxford University Press, Toronto

Racey, G.D., A.G. Harris, J.K. Jeglum, R.F. Foster and G.M. Wickware. 1996. Terrestrial and wetland ecosites of northwestern Ontario. Ontario Ministry of Natural Resources, Northwest Science and Technology. Field Guide FG-02. 94 p.

Ranta, B. (*ed*) 1998. Selected wildlife and habitat features: inventory manual. Ontario Ministry of Natural Resources, Queen's Printers, Peterborough, Ontario. 217 p.

Reid, D.J. 1991. Ontario Wild Turkey status report. Ontario Ministry of Natural Resources, Simcoe, Ontario. Unpublished report.

Riley, J. 1989. Distribution and status of vascular plants of southwestern Ontario. Ontario Ministry of Natural Resources, Aurora, ON.

Sims, R.A, W.D. Towill, K.A. Baldwin and G.M. Wickware. 1989. Field ecosystemclassification for northwestern Ontario. Forestry Canada and Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

Taylor, K.C., R.W. Arnup, B.G. Merchant, W.J. Parton, J. Nieppola. 2000. Field guide to forest ecosystems of northeastern Ontario. Second Edition Ontario Ministry of Natural Resources, NEST Field Guide FG-001. 218 p.

Varga and Allen 1990. County/regional municipality vascular plant floras for the Carolinian zone of Canada p 129 – 153. In Allen, G.M., P.F.J. Eagles and S.D. Price (*eds*) Conserving Carolinian Canada, University of Waterloo Press, Waterloo.

Voigt, D.R. and J.D. Broadfoot. 1995. Effects of cottage development on white-tailed deer, Odocoileus virginianus, winter habitat on Lake Muskoka, Ontario. Canadian Field Naturalist 109: 201-20.

Voigt, D.R., J.D. Broadfoot and J.A. Baker. 1997. Forest management guidelines for the provision of white-tailed deer habitat. Ontario Ministry of Natural Resources, Queen's Printer, Sault, Ste. Marie.

Weir, R.D. 1989. Birds of the Kingston Region. Kingston Field Naturalist and Quarry Press Inc. Kingston, Ontario. 608 p.

Weller, W. F. and M. J. Oldham. 1986. Ontario Herpetofaunal Summary. Ontario Field Herpetologists, Cambridge, Ontario. 221 p.

APPENDIX J

Natural Heritage Resources of Ontario: S-Ranks for Communities in Site Regions 6 and 7

The classification of communities in this appendix is a first approximation of a classification system for southern Ontario. It is based on a combination of empirical data, literature review and expert opinion of ecologists work in this field. The S-ranks are assigned on frequency of occurrence as described in the following pages.

INTRODUCTION

The mission of the Natural Heritage Information Centre (NHIC), Ontario Ministry of Natural Resources (OMNR), is to acquire, maintain and update, and make available data on the province's rare species, vegetation communities, and natural areas. Together, flora, fauna, and vegetation communities are considered to be 'elements' of biodiversity.

The NHIC actively collects information on rare vegetation types in Ontario, as well as information on high-quality, extensive examples of non-rare vegetation types. "Rare" in this case refers to those types which are ranked as S1, S2 or S3, as are explained later in this document. These data are stored and maintained in the NHIC central database, and are used for environmental and conservation planning and research.

This document lists the vegetation communities of southern Ontario that occur within Site Regions 6E and 7E (Figure 1), and provides global and provincial ranks for each community type, along with the rationale used to determine each provincial rank, as well as additional comments. Communities that are cultural (anthropogenic) in origin, and dominated by introduced species, are not tracked by the NHIC, and are excluded from this list.

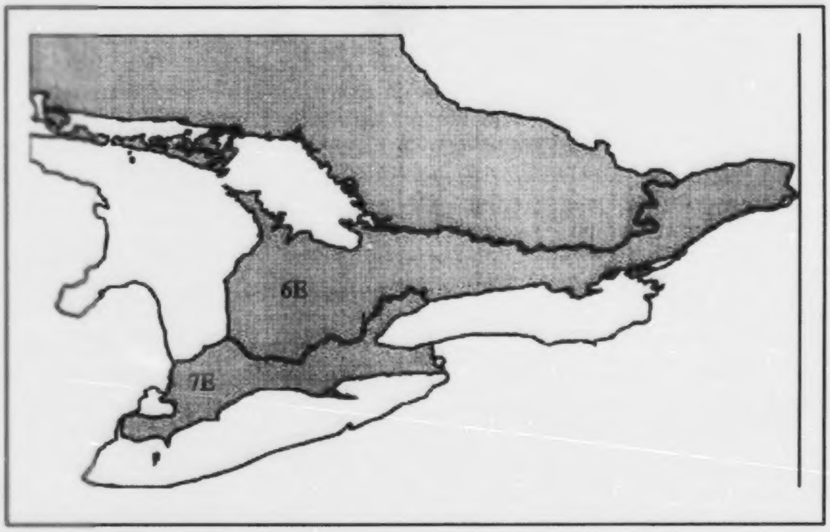


Figure 1. Southern Ontario, showing Site Regions 6E and 7E.

Site Region refers to an ecological subdivision of the land, based upon a combination of climate, physiography, and biological productivity. The Site Regions of Ontario were developed and mapped by Angus Hills (Hills 1961). The map below shows recent modifications to the Site Region boundaries, based on more detailed mapping and interpolation of physiographic features (Jalava *et al.* 1996).

The vegetation classification is based upon the Ecological Land Classification (ELC) for southern Ontario developed jointly by the Southcentral Region Science and Technology Transfer Unit (STTU) and the NHIC. This ELC currently exists as a first approximation; developed to 'rough out' a preliminary hierarchy and classification, based on the review, sorting and collation of existing information. These data have been collected from numerous sources, including OMNR reports, International Biological Program (IBP) inventories, consultant studies, and the published literature (Lee *et al*. 1996). This assembled information has been compiled into a Community Catalogue, which presents the ELC and lists documented associations for each vegetation type, as an aid to understanding and recognizing the vegetation types (Lee and Bakowsky 1996).

The OMNR is currently collecting quantitative quadrat data on the vegetation in these two site regions (6E and 7E) which, when completed, can be analyzed and correlated with environmental variables (soil, site and landscape) using multivariate methods to derive an updated and refined classification. Since this project is ongoing and will require several more years to complete, this first approximation will be used in the interim (Lee *et al*. 1996). The planned publication date for both this document and the Community Catalogue is 1997 (Harold Lee pers. comm.).

OUTLINE FORMAT

Column 1. System

System refers to a broad classification category for organizing the landscape, largely on the basis of moisture. In this ELC, there are three traditional systems:

- Aquatic
- Wetland
- Terrestrial

Aquatic systems are defined as shallow to deep open water not dominated by emergent vegetation. Wetlands are lands that are seasonally or permanently flooded, as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water-tolerant plants (OMNR 1993). Terrestial refers to all systems occurring on non-hydric soils. In some cases, such as the interface between terrestrial and either aquatic or wetland systems, these distinctions become less meaningful. For example, flat sandy beaches may be dry in some places and wet in others. Similar situations occur with gravel and bedrock shorelines which are exposed to fluctuating water levels. Out of necessity, these variable habitats need a 'place', and in this classification they reside in the terrestrial system

Column 2. Community Series I

The Community Series are useful units for grouping communities, based on similarities in physiognomy and site. The first Series is the broader of the two, organizing communities into largely widely-known units such as swamps, marshes, etc. This Series places a greater emphasis on physiognomic similarity.

Column 3. Community Series II

The second Series represents a refinement of the first Series, and broadly groups communities further along site criteria such as substrate and site moisture. For example, marshes are grouped into meadow marsh (drier) and shallow marsh (wetter).

Column 4. Ecosite and Vegetation Type

Ecosite is a mappable landscape unit defined by a relatively uniform parent material, soil and hydrology, and consequently supports a consistently recurring formation of plant species which develop over time (vegetation chronosequence). The Vegetation Type is part of an ecosite, and represents a specific assemblage of species which generally occur in a site with a more uniform parent material, soil and hydrology, and a more specific stage within a chronosequence.

In this document, the Vegetation Type represents the basic community unit that is ranked for conservation purposes. In some instances, where a vegetation type is known to occur but for which insufficient information exists, the classification is left at the ecosite level, and the ecosite receives the provincial rank.

Columns 5 & 6. Occurrence in Site Regions 6E and 7E

An 'X' in either column indicates the occurrence of a particular vegetation type within the site region, as documented in the Community Catalogue (Lee and Bakowsky 1996). In some cases, a community type or ecosite is known to occur in a site region, but no descriptions are available, thus it is not documented in the catalogue. In these instances, the column is marked as '(X)', which indicates it is present, but not listed in the catalogue.

Column 7. Global Rank (GRANK)

Heritage Programs such as the NHIC use a combination of global and provincial ranks as a tool to prioritize conservation and protection efforts, focusing efforts first on those elements of diversity that are both globally and provincially rare. Global ranks for each element are assigned by The Nature Conservancy (United States), based upon consideration of the provincial and state ranks assigned by heritage programs for the element across the range of its distribution, as well as the opinion of scientific experts.

The two major criteria used in determining a community's rank are the total number of occurrences and the total areal extent of the community range-wide. Secondary factors used in determining global rank include measures of the geographic range of an element's distribution, trends in status (eg. expanding or shrinking range), trends in condition (eg. declining condition of remaining areal extent), threats, and fragility (Grossman *et al.* 1994).

Until recently, global ranks were unavailable for community types, as there was no overall classification scheme that heritage programs could use to consistently classify vegetation according to similar standards. The Nature Conservancy (U.S.) has been working with the heritage programs to develop a standardized, hierarchical North American classification system appropriate for conservation planning and management, and for the long-term monitoring of ecological communities and ecosystems (Grossman *et al.* 1994). Global ranks for this list were provided by The Nature Conservancy (TNC), Midwestern Regional Office, Minneapolis, Minnesota, in December 1996.

Global ranks are defined as follows:

G1 **Critically imperiled** globally because of extreme rarity (5 or fewer occurrences or very few remaining hectares) or because of some factor(s) making it particularly vulnerable to extinction.

G2 **Imperiled globally** because of extreme rarity (6 to 20 occurrences or few remaining hectares) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 **Either very rare** and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (eg. a single province or physiographic region) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

Vegetation communities assigned lower ranks, such as **G4** and **G5**, are considered to be globally secure. A rank of G4 refers to a community which is apparently secure globally, while a rank of G5 indicates a community is demonstrably secure globally.

Global ranks can be modified further, usually in cases where insufficient information exists for a community type. For example, **G2G3** indicates that an element is rare, but it is not known if it is clearly G2 or G3. Since the global classification has only very recently been developed, and is based in some cases on incompletely documented community occurrences, in some cases there is uncertainty as to the validity or appropriateness of the global community type. In such cases, a rank of GQ may be applied. There are numerous information gaps for many communities, hence, a number of global types have insufficient information on which to properly determine rank. These have received an interim rank of G?, until more information on the community becomes available.

Column 8. Provincial Rank (SRANK)

The NHIC uses a ranking system that considers the provincial rank of an element (=species or community type) as a tool to prioritize protection efforts. These ranks are not legal designations. The provincial (=subnational) rank is known as SRANK. These ranks have been assigned using the best available scientific information, and follow a systematic ranking procedure developed by The Nature Conservancy (U.S.). The ranks are based on the three factors outlined in the three previous columns, namely: estimated number of occurrences, estimated community areal extent, and estimated range of the community within the province. The provincial ranks are explained below.

S1 **Extremely rare** in Ontario; usually 5 or fewer occurrences in the province, or very few remaining remaining hectares.

S2 **Very rare** in Ontario; usually between 5 and 20 occurrences in the province, or few remaining hectares.

S3 **Rare to uncommon** in Ontario;usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with some extensive examples remaining.

Communities are assigned lower ranks, such as S4 and S5, are considered to be common and widespread in Ontario. A rank of S4 denotes a community that is apparently secure in the province, with many occurrences, while S5 indicates it is demonstrably secure in the province.

The provincial ranks may be further modified. For example, S2S3 indicates that an element is rare, but insufficient information exists to accurately assign a single rank. SH indicates that an element is known from the province historically, but that it hasn't been seen in many years, although it is not known conclusively to be extirpated. SX indicates that an element is extirpated from the province.

It is important to note that while only those communities which occur in southern Ontario are listed here, many of them occur elsewhere in the province. Consequently, these ranks are intended to reflect their total provincial extent and distribution.

Column 9. Estimated Number of Community Element Occurrences

In the methodology employed by the NHIC, a species or community is referred to as an **element.** For the estimated number of element occurrences, the letter codes are:

A	1-5 occurrences
B	6-20 occurrences
C	21-100 occurrences
D	>100 occurrences

In some cases, such as when communities have disappeared to the point that they now exist mostly as tiny fragments, such as tallgrass prairie, only larger (e.g. > 2ha) occurrences are considered in the ranking.

Column 10. Estimated Areal Extent of the Community Element

The codes for the estimated areal extent of a community element within the province are:

A	< 1,000 ha
B	1,000 - 5,000 ha
C	5,000 - 25,000 ha
D	>25,000 ha

Column 11. Estimated Distribution Range of the Community Element

The codes for the estimated distribution range of the community element within the province are:

A	Very small range in province, < 3% of province area
B	Narrow range, > 3% but < 10% of province area
C	Moderately widespread, > 10% but < 50% of province area
D	Widespread, > 50% of the province area

Column 12. Comments

This column provides notes on various community types.

FINAL COMMENTS

The NHIC welcomes comments and information on community occurrences in the province, particularly those which are are ranked as rare, or which are high-quality, extensive examples of non-rare types. Also appreciated is any information or comments that would assist in refining the accuracy of assigned provincial ranks. See the next page for the mailing address.

LITERATURE CITED

Grossman, D.H., K.L. Goodin and C.L. Reuss, eds. 1994. Rare Plant Communities of the Conterminous United States, An Initial Survey. The Nature Conservancy, Arlington, Virginia.

Hills, G.A. 1961. The Ecological Basis for Land-use Planning. Ontario Department of Lands and Forests, Toronto. Research Report 46. 204 pp.

Jalava, J.V., J.L. Riley, D.G. Cuddy, and W.J. Crins. 1996. A Proposed Revision to Ecological Site District Boundaries in Site Regions 6 and 7 (Unpublished draft). Natural Heritage Information Centre, Peterborough, Ontario.

Lee, H.T. and W.D. Bakowsky. 1996. Community Catalogue for Southern Ontario (Unpublished draft). Ontario Ministry of Natural Resources, London, Ontario.

Lee, H.T., W.D. Bakowsky, J.L. Riley, H. Stewart, P. Neave, D. G. Cuddy, K. Coleman and P. Uhlig. 1996. An Ecological Community Classification for Southern Ontario: A First Approximation (Unpublished draft). Ontario Ministry of Natural Resources, Aurora, Ontario.

Ontario Ministry of Natural Resources. 1993. Ontario Wetland Evaluation System Southern Manual. 3rd Edition. NEST Technical Manual TM-002.

ACKNOWLEDGMENTS

The following people have contributed toward the development of the classification, or provided comments on the classification and/or the provincial ranks: Peter W. Ball, Jane M. Bowles, William J. Crins, Donald G. Cuddy, Don Faber-Langendoen, Anthony Goodban, Jarmo V. Jalava, Judith Jones, James Kamstra, Donald A. Kirk, Harold T. Lee, Douglas W. Larson, Michael J. Oldham, Murray Radford, John L. Riley, Claudia Schaefer, Donald A. Sutherland and David J. White.

Wasyl D. Bakowsky
Natural Heritage Information Centre
Ontario Ministry of Natural Resources
300 Water Street, 2nd Floor, North Tower
P.O. Box 7000
Peterborough, Ontario
K9J 8M5

telephone 705-755-2162
fax 705-755-2168

wasyl.bakowsky@mnr.gov.on.ca

COMMON NAME	**SCIENTIFIC NAME**
Balsam Fir	*Abies balsamea* L. Miller
Manitoba Maple	*Acer negundo* L.
Red Maple	*Acer rubrum* L.
Silver Maple	*Acer saccharinum* L.
Black Maple	*Acer saccharum* Marhsall ssp. *nigrum* (Michaux f.) Desmarais
Sugar Maple	*Acer saccharum* Marshall. ssp. *saccharum*
Mountain Maple	*Acer spicatum* Lam.
Maple	*Acer* spp.
Swamp Maple	*Acer x freemanii* E. Murr. [*rubrum x saccharinum*]
Red-top	*Agrostis gigantea* Roth
Nodding Onion	*Allium cernuum* Roth
Alder	*Alnus* spp.
Serviceberry	*Amelanchier* spp.
Beachgrass	*Ammophila breviligulata* Fern.
Chokeberry	*Aronia melanocarpa* (Michaux) Elliott *[= Pyrus melanocarpa]*
Wormwood	*Artemisia campestris* L. ssp. *caudata* (Michaux) H.M. Hall & Clements
Paw-paw	*Asimina triloba* (L.) Dunal
Yellow Birch	*Betula alleghaniensis* Britton
White Birch	*Betula papyrifera* Marshall
Fen Birch	*Betula pumila* L.
Lowland Ash	Black Ash, Green Ash, Red Ash
Sea Rocket	*Cakile edentula* (Bigelow) Hook.
Bluejoint	*Calamagrostis canadensis* (Michaux) P. Beauv.
Long-leaved Reed Grass	*Calamovilfa longifolia* (Hook.) Scribner var. *magna* Scribner & Merr.
Calla Lily	*Calla palustris* L.
Slender Sedge	*Carex lasiocarpa* Ehrh.
Few-seeded Sedge	*Carex oligosperma* Michaux
Hay Sedge	*Carex siccata* Dewey *[= C. foenea]*
Sedge	*Carex* spp.
Beaked Sedge	*Carex utriculata* F. Boott
Bitternut Hickory	*Carya cordiformis* (Wang.) K. Koch
Shagbark Hickory	*Carya ovata* (Miller) K. Koch
Hickory	*Carya* spp.
Hackberry	*Celtis occidentalis* L.
Buttonbush	*Cephalanthus occidentalis* L.
Leatherleaf	*Chamaedaphne calyculata* (L.) Moench
Stonewort	*Chara* spp.
Twig-rush	*Cladium mariscoides* (Muhlenb.) Torrey
Silky Dogwood	*Cornus amomum* Miller ssp. *obliqua* (Raf.) J.S. Wilson *[= C. obliqua]*
Gray Dogwood	*Cornus foemina* Miller ssp. *racemosa* (Lam.) J.S. Wilson *[C. racemosa]*
Round-leaved Dogwood	*Cornus rugosa* Lam.
Red-osier	*Cornus stolonifera* Michaux
Hawthorn	*Crataegus* spp.
Bulblet Fern	*Cystopteris bulbifera* (L.) Bernh.
Water Willow	*Decodon verticillatus* (L.) Elliott
Tufted Hairgrass	*Deschampsia cespitosa* (L.) P. Beauv.
Spike Rush	*Eleocharis* spp.
Waterweed	*Elodea* spp.
Slender Wheat-grass	*Elymus trachycaulus* (Link) Gould in Shinn. *[Agropyron trachycaulum]*
Great Lakes Wheat-grass	*Elymys lanceolatus* (Scribner & J.G. Smith) Gould ssp. *psammophilus* (J.M. Gillett & Senn) A. Löve *[=Agropyron psammophilum]*
Horsetail	*Equisetum* spp.

COMMON NAME	**SCIENTIFIC NAME**
Cotton-grass	*Eriophorum* spp.
Beech	*Fagus grandifolia* Ehrh.
White Ash	*Fraxinus americana* L.
Black Ash	*Fraxinus nigra* Marshall
Green Ash	*Fraxinus pennsylvanica* Marshall
Red Ash	*Fraxinus pennsylvanica* Marshall
Huckleberry	*Gaylussacia baccata* (Wang.) K. Koch
Herb Robert	*Geranium robertianum* L.
Fowl Manna Grass	*Glyceria* spp.
Water Star-grass	*Heteranthera dubia* (Jacq.) MacMillan
Winterberry	*Ilex verticillata* (L.) A. Gray
Jewelweed	*Impatiens* spp.
Low Sedge	includes *Carex chordorrhiza* Ehrh., *C. limosa* L., *C. livida* (Wahlenb.) Willd.
Butternut	*Juglans cinerea* L.
Black Walnut	*Juglans nigra* L.
Common Juniper	*Juniperus communis* L.
Juniper	*Juniperus communis* L. and *Juniperus horizontalis* Moench
Creeping Juniper	*Juniperus horizontalis* Moench
Red Cedar	*Juniperus virginiana* L.
European Larch	*Larix decidua* Miller
Tamarack	*Larix laricina* (DuRoi) K. Koch
Japanese Larch	*Larix leptolepis* (Sieb. & Zucc.) Gord.
Rice Cut-grass	*Leersia* spp.
Duckweed	*Lemna* spp.
Spicebush	*Lindera benzoin* (L.) Blume
Tulip Tree	*Liriodendron tulipifera* L.
Water Marigold	*Megalodonta beckii* (Torrey ex Sprengel) E. Greene *[= Bidens beckii]*
Bog Buckbean	*Menyanthes trifoliata* L.
Sweet Gale	*Myrica gale* L.
Water Milfoil	*Myriophyllum* spp.
Watercress	*Nasturtium officinale* R. Br. Ex Aiton and *N. microphyllum* (Boenn.) Reichb.
American Lotus	*Nelumbo lutea* (Willd.) Pers.
Mountain Holly	*Nemopanthus mucronatus* (L.) Loes.
Bullhead Lily	*Nuphar* spp.
Water Lily	*Nymphaea* spp.
Ironwood	*Ostrya virginiana* (Miller) K. Koch
Philadelphia Panic Grass	*Panicum philadelphicum* Bernh. ex Trin.
Switchgrass	*Panicum virgatum* L.
Cliffbrake	*Pellaea* spp.
Reed-canary Grass	*Phalaris arundinacea* L.
Rush Grass	*Phragmites australis* (Cav.) Trin ex Steudel *[= P. communis]*
Ninebark	*Physocarpus opulifolius* (L.) Maxim.
Norway Spruce	*Picea abies* (L.) Karsten
White Spruce	*Picea glauca* (Moench) Voss
Black Spruce	*Picea mariana* (Miller) Britton, Sterns & Pogg.
Red Spruce	*Picea rubens* Sarg.
Jack Pine	*Pinus banksiana* Lambert
Red Pine	*Pinus resinosa* Sol. ex Aiton
Pitch Pine	*Pinus rigida* P. Mill.
Pine	*Pinus* spp.
White Pine	*Pinus strobus* L.
Scotch Pine	*Pinus sylvestris* L.
Canada Bluegrass	*Poa compressa* L.
Pickerel-weed	*Pontederia cordata* L.

COMMON NAME	SCIENTIFIC NAME
Balsam Poplar	*Populus balsamifera* L.
Poplar	*Populus balsamifera* L. and *Populus grandidentata* Michaux
Cottonwood	*Populus deltoides* Bartram ex Marshall
Aspen	*Populus tremuloides* Michaux
Hybrid Poplar	*Populus x*
Pondweed	*Potamogeton* spp.
Shrubby Cinquefoil	*Potentilla fruticosa* L.
Sand Cherry	*Prunus pumila* L.
Black Cherry	*Prunus serotina* Ehrh.
Chokecherry	*Prunus virginiana* L.
Hop-tree	*Ptelea trifoliata* L.
Bracken Fern	*Pteridium aquilinum* (L.) Kuhn
White Oak	*Quercus alba* L.
Swamp White Oak	*Quercus bicolor* Willd.
Bur Oak	*Quercus macrocarpa* Michaux
Chinquapin Oak	*Quercus muehlenbergii* Engelm.
Pin Oak	*Quercus palustris* Muenchh.
Red Oak	*Quercus rubra* L. *[= Q. borealis]*
Shumard's Oak	*Quercus shumardii* Buckley
Oak	*Quercus* spp.
Black Oak	*Quercus velutina* Lam.
Fragrant Sumac	*Rhus aromatica* Aiton
Poison Ivy	*Rhus radicans* L.
Sumac	*Rhus typhina* L. and *R. glabra* L.
Poison Sumac	*Rhus vernix* L.
Raspberry	*Rubus idaeus* L.
Black Willow	*Salix nigra* Marshall
Willow	*Salix* spp.
Sassafras	*Sassafras albidum* (Nutt.) Nees
Little Bluestem	*Schizachyrium scoparium* (Michaux) Nees *[= Andropogon scoparius]*
Clubrush	*Scirpus hudsonianus* (Michaux) Fern. and *S. cespitosus* L.
Threesquare	*Scirpus pungens* M. Vahl *[= S. americanus]*
Bulrush	*Scirpus* spp.
Bur-reed	*Sparganium* spp.
Prairie Slough Grass	*Spartina pectinata* Link
Meadowsweet	*Spiraea* spp.
Northern Dropseed	*Sporobolus heterolepis* (A. Gray) A. Gray
White Cedar	*Thuja occidentalis* L.
Basswood	*Tilia americana* L.
False Pennyroyal	*Trichostema brachiatum* L. *[= Isanthus brachiatus]*
Hemlock	*Tsuga canadensis* (L.) Carriere
Cattail	*Typha* spp.
White Elm	*Ulmus americana* L.
Bladderwort	*Uticularia* spp.
Highbush Blueberry	*Vaccinium corymbosum* L.
Velvet-leaf Blueberry	*Vaccinium myrtilloides* Michaux
Blueberry	*Vaccinium* spp.
Wild Celery	*Vallisneria americana* Michaux
Nannyberry	*Viburnum lentago* L.
Southern Arrow-wood	*Viburnum dentatum* L. var. *lucidum* Ait *[= V. recognitum]*
Prickly Ash	*Zanthoxylum americanum* Miller *[= Xanthoxylum americanum]*
Wild-rice	*Zizania* spp.

COMMUNITY FIELD REPORTING FORM

NATURAL HERITAGE INFORMATION CENTRE
P.O. Box 7000, Peterborough, Ontario, K9J 8M5, (705) 755 - 2162, FAX (705) 755 - 2168

Ministry of
Natural
Resources

INSTRUCTIONS - PLEASE READ CAREFULLY

1. **Important**: this form to be COMPLETED BY THE PERSON WHO MADE THE OBSERVATION and is for reporting FIRST-HAND ON-SITE FIELD OBSERVATIONS; do NOT use this form to report second-hand data from a letter, report, or conversation. Send us a copy of the letter, report, memo etc. and we will process it in another manner.
2. Complete ONE FORM per COMMUNITY per SITE. Use a pen or dark pencil.
3. Data sheets or cards from a standard survey method (eg. quadrat) may be attached to this sheet.
4. **Very Important**: attach a copy of the NTS or OBM topographic map indicating the location/boundary of the community (see next page).

COMMUNITY TYPE:

OBSERVATION DATA:

LAST observed: month:____ day:____ yr:____ FIRST observed: month:____ day:____ yr: ____

Name of observer(s):

Address:

Telephone:

FAX:

Others knowledgeable about this occurrence (name, address, telephone):

LOCATIONAL DATA:

SURVEY SITE NAME (local or place name):

TOPOGRAPHIC MAP NAME:

DATUM (eg. NAD27):

TOPOGRAPHIC MAP NUMBER:

CENTROID UTM:

GRID ZONE:

COUNTY OR DISTRICT:

TOWNSHIP:

SITE DISTRICT (Hill's Site Region and district):

DIRECTIONS TO THE OCCURRENCE: Describe in detail the PRECISE LOCATION of the community occurrence. Refer to nearby topographic landmarks and street names. Include distances whenever possible. Be clear and concise:

COMMUNITY PROFILE SKETCH:

COMMUNITY FIELD REPORTING FORM

NATURAL HERITAGE INFORMATION CENTRE
P.O. Box 7000, Peterborough, Ontario, K9J 8M5, (705) 755 - 2162, FAX (705) 755 - 2168

Ministry of
Natural
Resources

COMMUNITY INFORMATION:

DOMINANT SPECIES:

OTHER SPECIES:

COMMUNITY DESCRIPTION (describe structure and composition of community in terms of layers):

ADJACENT COMMUNITIES:

MOSAIC COMMENTS:

SUCCESSIONAL DYNAMICS:

DISTURBANCE COMMENTS:

SPECIES LIST: IMPORTANT - If a species list for the community has been compiled, ATTACH (staple) a PHOTOCOPY of the species list. Also indicate the date the list was compiled, and the approximate time spent compiling the list. **SPECIES LIST ATTACHED**: Y N

ENVIRONMENTAL INFORMATION:

LANDFORM (eg. alluvial sand plain, gound moraine, bedrock):

TOPOGRAPHIC POSITION:

GEOLOGY:

SOIL TYPE: SITE MOISTURE: DRAINAGE:

SOIL DESCRIPTION:

HYDROLOGICAL INFLUENCE:

TOPOGRAPHIC MAP: (VERY IMPORTANT) - ATTACH (staple) a PHOTOCOPY of the appropriate portion of the TOPOGRAPHIC MAP for the area, and indicate the precise location of each community occurrence centroid, and preferably draw a boundary or apporximate boundary for the community. If the community occurs as a mosaic within an area, please indicate this on the map with a comment.

FORM FILLED OUT BY: Name: Date:
Address:

**Natural Heritage Information Centre
Community Type Provincial
Ranks**

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
Aquatic: shallow to deep open water without emergent vegetation dominance (standing water always present)											
	Lacustrine / Riverine										
		Open Water		(X)	(X)	NA	S5	D	D	D	
		Shallow Water									these community types are poorly documented and described in Ontario
			Submerged Shallow Aquatic Ecosite								
			Pondweed Submerged Shallow Aquatic Type	X	X	G5Q	S5	D	D	D	should be subdivided further, but more information needed
			Waterweed Submerged Shallow Aquatic Type	X	X	G5Q	S4S5	D	B?	B?	
			Stonewort Submerged Shallow Aquatic Type	X	X	G5Q	S4S5	D	BC?	D	
			Water Milfoil Submerged Shallow Aquatic Type	X	X	G?	S5	D	C	D	
			Wild Celery Submerged Shallow Aquatic Type	X	(X)	G?	S4	D	C	C	
			Water Marigold Submerged Shallow Aquatic Type	X	(X)	G?	S4	D	BC?	C?	
			Water Star-grass Submerged Shallow Aquatic	X	(X)	G5Q	S3S4	D	B?	C	
			Submerged - Floating-leaved Shallow Aquatic Ecosite								
			Pickerel-weed Submerged - Floating-leaved Shallow Aquatic Type	X	X	G5	S5	D	CC	D	
			Duckweed Submerged - Floating-leaved Shallow Aquatic Type	X	(X)	G5Q	S5	D	CD	D	
			Watercress Submerged Shallow Aquatic Type	X	X	G5Q	S4	D	A?	D	
			Pondweed Submerged - Floating-leaved Shallow Aquatic Type	X	(X)	G5Q	S5	B	CD	D	should be subdivided further, but more information needed
			Bur-reed Submerged - Floating-leaved Shallow Aquatic Type	X	(X)	G5Q	S5	D	CD	D	
			Bladderwort Submerged - Floating-leaved Shallow Aquatic Type	X	(X)	G5Q	S5	D	C	D	
			Water-milfoil Submerged - Floating-leaved Shallow Aquatic Type	(X)	X	G?	S5	D	CD	D	
			Floating-leaved Shallow Aquatic Ecosite								
			Water Lily - Bullhead Lily Floating-leaved Shallow Aquatic Type	X	X	G5	S5	D	D	D	
			American Lotus Floating-leaved Shallow Aquatic Type		X	G5	S1	AB	A	A	
			Duckweed Floating-leaved Shallow Aquatic Type	X	X	G5Q	S5	D	C	C?	
Wetland: Lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants.											
	Marsh										
		Meadow Marsh									
			Great Lakes Coastal Meadow Marsh Ecosite ('Shoreline Fen' or 'Panne')								
			Graminoid Coastal Meadow Marsh Type	X	X	G2?	S2	C	AB	B	occur along Great Lakes shores and wet dune 'pannes' or 'wet meadows', composition varies with changes in water levels
			Shrubby Cinquefoil Coastal Meadow Marsh Type	X	X	G2?	S1	B	A	B	occurs along drier, less frequently inundated portions of above habitats
			Wet - Moist Tallgrass Prairie Meadow Marsh Ecosite								
			Wet Bluejoint-Prairie Slough Grass Tallgrass Prairie Meadow Marsh Type		X	G2G3	S1	B	A	A	fewer than 5 extensive (>2 ha) EO's known, similar to Meadow Marsh, but grows in mosaic with tallgrass prairie, includes prairie species in its composition
			Mineral Meadow Marsh Ecosite								
			Bluejoint Mineral Meadow Marsh Type	X	X	G5?	S5	D	D	D	
			Fowl Manna Grass Mineral Meadow Marsh Type	X	X	G?	S4	D	AB	C	
			Narrow-leaved Sedge Mineral Meadow Marsh	X	X	G4?	S5	D	D	D	eg. <5mm leaf width
			Broad-leaved Sedge Mineral Meadow Marsh Type	X	X	G4G5Q	S5	D	D	D	eg. >5mm leaf width

**Natural Heritage Information Centre
Community Type Provincial
Ranks**

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Forb Mineral Meadow Marsh Type	X	X	G?	S4S5	D	C	D	
			Horsetail Mineral Meadow Marsh Type	X	X	G?	S5	D	CD	D	
			Prairie Slough Grass Mineral Meadow Marsh Type	X	(X)	G2G3	S3	CD	AB	CD	does not occur in association with tallgrass prairie, prairie species absent
			Jewelweed Mineral Meadow Marsh Type	(X)	X	G?	S4	D	AB	D	
			Organic Meadow Marsh Ecosite								
			Bluejoint Organic Meadow Marsh Type	X	X	G5?	S5	D	D	D	
			Rice Cut-grass Organic Meadow Marsh Type	X	X	G?	S4	D	BC	C	
			Fowl Manna Grass Organic Meadow Marsh Type	X	X	G?	S4	D	AB	C	
			Narrow-leaved Sedge Organic Meadow Marsh Type	X	X	G4?	S5	D	D	D	eg. <5mm leaf width
			Broad-leaved Sedge Organic Meadow Marsh Type	X	X	G4G5Q	S5	D	D	D	eg. >5mm leaf width
			Forb Organic Meadow Marsh Type	X	X	G?	S4S5	D	C	D	
			Prairie Slough Grass Organic Meadow Marsh Type	X	(X)	G2G3	S3	CD	AB	CD	
			Jewelweed Organic Meadow Marsh Type	(X)	X	G?	S4	D	AB	D	
		Shallow Marsh									
			Mineral Shallow Marsh Ecosite								
			Cattail Mineral Shallow Marsh Type	X	X	G5	S5	D	D	D	
			Bulrush Mineral Shallow Marsh Type	X	X	G?	S5	D	D	D	
			Narrow-leaved Sedge Mineral Shallow Marsh Type	X	X	G4?	S5	D	D	D	eg. <5mm leaf width
			Broad-leaved Sedge Mineral Shallow Marsh Type	X	X	G4G5Q	S5	D	D	D	eg. >5mm leaf width
			Forb Mineral Shallow Marsh Type	X	X	G?	S4	D	CD	D	marshes dominated by mixtures of forbs (=herbs)
			Wild-rice Mineral Shallow Marsh Type	X	(X)	G?	S5	D	D	D	
			Threesquare Mineral Shallow Marsh Type	X		G4G5	S4	D	CD	D	
			Bur-reed Mineral Shallow Marsh Type	(X)	X	G4G5	S4	D	C	D	
			Rice Cut-grass Mineral Shallow Marsh Type		X	G?	S4	D	BC	C	
			Organic Shallow Marsh Ecosite								
			Cattail Organic Shallow Marsh Type	X	X	G5	S5	D	D	D	
			Bulrush Organic Shallow Marsh Type	X	X	G?	S5	D	D	D	
			Narrow-leaved Sedge Organic Shallow Marsh Type	X	X	G4?	S5	D	D	D	eg. <5mm leaf width
			Broad-leaved Sedge Organic Shallow Marsh Type	X	X	G4G5Q	S5	D	D	D	eg. >5mm leaf width
			Water Willow Organic Shallow Marsh Type	X	X	G?	S4	D	BC	B	a herbaceous species, not a shrub
			Forb Organic Shallow Marsh Type	X	X	G?	S4S5	D	CD	D	marshes dominated by mixtures of forbs (=herbs)
			Common Reed Grass Organic Shallow Marsh Type	X		G3G4	S4	D	C	D	if fen indicator species present, see fen section
			Wild-rice Organic Shallow Marsh Type	X	(X)	G?	S5	D	D	D	
			Bur-reed Organic Shallow Marsh Type	(X)	X	G4G5	S5	D	D	D	
			Rice Cut-grass Organic Shallow Marsh Type		X	G?	S4	D	BC	C	
			Spike-rush Organic Shallow Marsh Type	(X)	X	G4G5	S4S5	D	C	D	
			Calla Lily Organic Shallow Marsh Type	(X)	X	G?	S4	D	BC	D	
		Thicket Swamp									
			Mineral Thicket Swamp Ecosite								
			Alder Mineral Thicket Swamp Type	X	X	G5?	S5	D	D	D	
			Willow Mineral Thicket Swamp Type	X	X	G5	S5	D	D	D	
			Mountain Maple Mineral Thicket Swamp Type	X	X	G?	S4	D	C	D	
			Buttonbush Mineral Thicket Swamp Type	X	X	G4	S3	C	AB	B	
			Red-osier Mineral Thicket Swamp Type	X	X	G5	S5	D	D	D	
			Meadowsweet Mineral Thicket Swamp Type	X	X	G?	S5	D	D	D	
			Ninebark Mineral Thicket Swamp Type		X	G?	S4	CD	D	CD	
			Silky Dogwood Mineral Thicket Swamp Type		X	G5	S3S4	C	B	B	
			Gray Dogwood Mineral Thicket Swamp Type		X	G5	S3S4	C	B	B	
			Nannyberry Mineral Thicket Swamp Type	(X)	X	G?	S4	D	BC	C	
			Southern Arrow-wood Mineral Thicket Swamp Type		X	G?	S3	C	B	C	
			Paw-paw Mineral Thicket Swamp Type		X	G?	S1	AB	A	AB	occurs on sites wet in spring, dry by summer

Natural Heritage Information Centre
Community Type Provincial
Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Organic Thicket Swamp Ecosite								
			Alder Organic Thicket Swamp Type	X	X	G5?	S5	D	D	D	
			Willow Organic Thicket Swamp Type	X	X	G5	S5	D	D	D	
			Mountain Maple Organic Thicket Swamp Type	X	X	G?	S4	D	C	D	
			Buttonbush Organic Thicket Swamp Type	X	X	G4	S3	C	AB	B	
			Red-osier Organic Thicket Swamp Type	X	X	G5	S5	D	D	D	
			Sweet Gale Organic Thicket Swamp Type	X	X	G?	S5	D	D	D	
			Winterberry Organic Thicket Swamp Type	X		G3G4Q	S3S4	CD	BC	C	
			Mountain Holly Organic Thicket Swamp Type	X		G?	S3S4	CD	BC	C	
			Fen Birch Organic Thicket Swamp Type	X		G4G5	S4	D	C	C	
			Gray Dogwood Organic Thicket Swamp Type		X	G5	S4	D	B	B	
			Spicebush Organic Thicket Swamp Type	(X)	X	G?	S3	C	AB	B	
			Nannyberry Organic Thicket Swamp Type	(X)	X	G?	S4	D	BC	C	
			Poison Sumac Organic Thicket Swamp Type		X	G4?	S3	C	AB	C	
			Huckleberry Organic Thicket Swamp Type		X	G2Q	S1	A	A	A	only known from Dorchester Swamp, 2 ha
		Deciduous Mineral Swamp (includes Wet Woods)									
			Oak Deciduous Mineral Swamp Ecosite								
			Swamp White Oak Mineral Deciduous Swamp Type	X	X	G1G2Q	S2S3	BC	B	AB	Swamp White Oak hybridizes with Bur Oak
			Bur Oak Mineral Deciduous Swamp Type	X	X	G2G3Q	S3	BC	BC	BC	
			Pin Oak Mineral Deciduous Swamp Type		X	G2	S2S3	BC	AB	A	
			Ash Deciduous Mineral Swamp Ecosite								
			Black Ash Mineral Deciduous Swamp Type	X	X	G4	S5	D	D	D	
			Red / Green Ash Mineral Deciduous Swamp Type	X	X	G?	S5	D	D	D	
			Maple Deciduous Mineral Swamp Ecosite								
			Silver / Rad Maple Mineral Deciduous Swamp Type	X	X	G4?	S5	D	D	BC	most of Ontario's trees are hybrids between these two species (Acer x freemanii)
			Manitoba Maple - Willow Mineral Deciduous Swamp Type	(X)	X	G?	S5	D	C	C	wet in spring, dry in summer, the open treed vegetation along floodplains
			White Elm Deciduous Mineral Swamp Ecosite								
			White Elm Mineral Deciduous Swamp Type	X	X	G?	S5	D	D	C	now dominated by saplings and immature trees due to Dutch Elm Disease
			Aspen - White Birch - Poplar Mixed Deciduous Mineral Swamp Ecosite								
			Aspen - White Birch - Poplar Mineral Deciduous Swamp Type	X	X	G5	S5	D	D	D	
			Yellow Birch Mineral Deciduous Swamp Ecosite								
			Yellow Birch Mineral Deciduous Swamp Type	X	X	G4	S5	D	D	D	
		Deciduous Organic Swamp									
			Ash Deciduous Organic Swamp Ecosite								
			Black Ash Deciduous Organic Swamp Type	X	X	G4	S5	D	D	D	
			Maple Deciduous Organic Swamp Ecosite								
			Silver / Red Maple Deciduous Organic Swamp Type	X	X	G4?	S5	D	D	BC	most of Ontario's trees are hybrids between these two species (Acer x freemanii)
			Aspen - White Birch - Poplar Organic Swamp Ecosite								
			Aspen - White Birch - Poplar Deciduous Organic Swamp Type	X	X	G5	S5	D	D	D	
		Mixed Mineral Swamp									
			White Cedar - Mixed Mineral Swamp Ecosite								
			White Cedar - White Birch Mixed Mineral Swamp Type	X	X	G4?	S5	D	D	D	
			White Cedar - Mixed Mineral Swamp Type	X	X	G4?	S5	D	D	D	
			Red Maple Mixed Mineral Swamp Ecosite								
			Red Maple - Hemlock Mixed Mineral Swamp Type	X	(X)	G3	S3S4	C	BC	C	

Natural Heritage Information Centre
Community Type Provincial
Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
		Mixed Organic Swamp									
			White Cedar Mixed Organic Swamp Ecosite								
			White Cedar - Black Ash Mixed Organic Swamp Type	X	X	G?	S5	D	D	D	
			White Cedar - Yellow Birch Mixed Organic Swamp Type	X	(X)	G4?	S5	D	CD	C	
			White Cedar - White Birch Mixed Organic Swamp Type	X	X	G4?	S5	D	D	D	
			White Cedar Mixed Organic Swamp Type	X	X	G4?	S5	D	D	D	
			Red Maple Mixed Organic Swamp Ecosite								
			Red Maple - Hemlock Mixed Organic Swamp Type	X	(X)	G3	S3S4	C	BC	C	
			Red Maple - Balsam Fir Mixed Organic Swamp Type	X		G4?	S5	D	D	D	
			Red Maple - Tamarack Mixed Organic Swamp Type	(X)	X	G4?	S4S5	D	CD	C	
		Coniferous Mineral Swamp									
			White Cedar Mixed Mineral Swamp Ecosite								
			White Cedar - Balsam Fir Coniferous Mineral Swamp Type	X		G4	S5	D	D	D	
			White Cedar - Hemlock Coniferous Mineral Swamp	X		G?	S3S4	C	BC	C	
			White Cedar - White Spruce Coniferous Mineral Swamp Type	X		G4	S5	D	D	D	
			White Pine Coniferous Mineral Swamp Ecosite								
			White Pine Coniferous Mineral Swamp Type	(X)	X	G3G4	S2	AB	A	B	occur along borders of kettle peatlands
		Coniferous Organic Swamp									
			Tamarack - Black Spruce Coniferous Organic Swamp Ecosite								
			Tamarack Coniferous Organic Swamp Type	X	X	G4	S5	D	D	D	
			Tamarack - Black Spruce Coniferous Organic Swamp Type	X	X	G5Q	S5	D	D	D	
			Black Spruce Coniferous Organic Swamp Type	X		G5	S5	D	D	D	
			White Cedar Coniferous Organic Swamp Ecosite								
			White Cedar Coniferous Organic Swamp Type	X	(X)	G4	S5	D	D	D	
			White Cedar - Tamarack Coniferous Organic Swamp Type	X	X	G4G5	S5	D	D	D	
			White Cedar - Balsam Fir Coniferous Organic Swamp Type	X		G4	S5	D	D	D	
			White Cedar - Black Spruce Coniferous Organic Swamp Type	X		G4	S5	D	D	D	
			White Cedar - Hemlock Coniferous Organic Swamp Type	X		G?	S3S4	C	BC	C	
			White Cedar - White Spruce Coniferous Organic Swamp Type	X		G4	S5	D	D	D	
	Fen										fen indicators present, more species than in bogs, mineralized groundwater
		Open Fen									
			Graminoid Fen Ecosite								
			Twig-rush Graminoid Fen Type	X	X	G3Q	S3?	C	BC	C	
			Slender Sedge Graminoid Fen Type	X		G4G5	S5	D	D	D	*Carex lasiocarpa*
			Low Sedge - Clubrush Graminoid Fen Type	X		G2G4Q	S4	CD	CD	D	
			Beaked Sedge Graminoid Fen Type	X		G4?	S4S5	D	CD	D	*Carex utriculata*
			Bog Buckbean Graminoid Fen Type	X		G3G4	S3S4	CD	BC	CD	
			Perched Mineral Prairie Fen Type		X	G3G4	S1	A	A	A	soils mineral, occur on mineralized seepage slopes, mixture of fen and prairie species

Natural Heritage Information Centre
Community Type Provincial
Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Shrub Fen Ecosite								
			Sweet Gale Shrub Fen Type	X		G?	S5	D	D	D	
			Fen Birch Shrub Fen Type	X		G4G5	S5	D	D	D	*Betula pumila*
			Low White Cedar Shrub Fen Type	X		G?	S4S5	CD	CD	D	
			Leatherleaf - Forb Shrub Fen Type	X		G5	S5	D	D	D	
			Shrubby Cinquefoil Shrub Fen Type	X		G3G4	S4	CD	CD	D	
			Velvet-leaf Blueberry Shrub Fen Type	X		G5	S5	D	CD	D	
			Mountain Holly Shrub Fen Type	X		G3G4	S3S4	C	AC	C	
			Chokeberry Shrub Fen Type	X		G3G4	S3S4	C	AC	C	
			Highbush Blueberry - Leatherleaf Shrub Fen Type	X	X	G2Q	S2S3	B	AB	BC	
		Treed Fen									
			Treed Fen Ecosite								
			Tamarack Treed Fen Type	X	X	G4?	S5	D	D	D	
			Tamarack - White Cedar Treed Fen Type	X		G4?	S5	D	D	D	
			Gray Birch Treed Fen Type	X		G4?	S2S3	C	BC	C	occur along borders of fens
	Bog										species-poor, fen indicators few or absent
		Open Bog									
			Graminoid Bog Ecosite								
			Few-seeded Sedge Graminoid Bog Type	X		G3G4	S5	D	D	D	*Carex oligosperma*
			Cotton-grass Graminoid Bog Type	X		G3G4	S5	D	D	D	
			Shrub Bog Ecosite								
			Leatherleaf Shrub Bog Type	X		G5	S5	D	D	D	
		Treed Bog									
			Treed Bog Ecosite								
			Black Spruce Treed Bog Type	X		G5	S5	D	D	D	
	Kettle Peatland										occur in kettles, local areas of bog and fen within, both fen and bog indicator species present
		Open Kettle Peatland									
			Shrub Kettle Peatland Ecosite								
			Leatherleaf Shrub Kettle Peatland Type		X	G3G4	S3	C	A	A	
			Highbush Blueberry Shrub Kettle Peatland Type		X	G2Q	S1S2	AB	A	A	
		Treed Kettle Peatland									
			Treed Kettle Peatland Ecosite								
			Tamarack-Leatherleaf Treed Kettle Peatland Type		X	G3G4	S3	C	A	A	
Terrestrial [illegible]											
	[illegible]										
		[illegible]									these communities interface with water, may be wet due to fluctuating water levels, and violate the strict terrestrial definition
			Open Sand Beach / Bar Ecosite								
			Sea Rocket Sand Beach Type	X	X	G2G4	S2S3	BC	AB	A	consists mostly of bare sand
			Gravel / Shingle / Cobble Beach / Bar Ecosite								
			Wormwood Gravel Beach Type	X		G3G4	S2S3	BC	AB	A	
			Red Cedar-Common Juniper Shingle Beach Type	X		G3G4	S1	AB	A	A	
			Willow Gravel Bar Type	X	(X)	G?	S4	D	AB	D	

Natural Heritage Information Centre
Community Type Provincial
Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Limestone Bedrock Beach / Bar Ecosite								
			Shrubby Cinquefoil Limestone Beach Type	X	X	G3G4	S2	BC	A	A	wave-washed areas, may occur adjacent to alvars adjacent to shoreline
			Sandstone Bedrock Beach / Bar Ecosite	(X)		G4?	S1	A	A	C	
			Granite Bedrock Beach / Bar Ecosite	(X)		G4?	S5	D	CD	D	
		Sand Dune									
			Dune Grassland Ecosite								
			Little Bluestem - Switchgrass - Beachgrass Dune Grassland Type	X	X	G?	S2	B	B	A	
			Little Bluestem - Long-leaved Reed Grass - Great Lakes Wheat Grass Dune Grassland Type	X	X	G?	S2	B	B	A	Calamovilfa longifolia, Elymus lanceolatus ssp. psammophilus (=Agropyron psammophilum)
			Dune Shrubland Ecosite								
			Sand Cherry Dune Shrubland Type	X	X	G2Q	S2	B	A	A	
			Juniper Dune Shrubland Type	X	X	G?	S2	B	AB	A	
			Hop-tree Dune Shrubland Type		X	G2Q	S1	A	A	A	
			Dune Savannah Ecosite								
			Cottonwood Dune Savannah Type	X	X	G1G2	S1	A	A	A	
			Red Cedar Dune Savannah Type		X	G?	S1	A	A	A	
			Balsam Poplar Dune Savannah Type		X	G1G2	S1	A	A	A	
		Bluff									
			Shale / Clay Bluff Ecosite								
			Open Clay Bluff Type	(X)	X	G?	S4	C	AB	C	
			Sand / Till Bluff Ecosite								
			Open Sand / Clay Bluff Type	(X)	(X)	G?	S4	C	AB	C	
	Cliff, Talus, Crevice and Cave										
		Cliff									
			Open Limestone / Dolostone Cliff Ecosite								
			Cliffbrake - Lichen Open Unshaded Limestone / Dolostone Cliff Face Type	X	X	G5	S3	C	A	A	
			Bulblet Fern - Herb Robert Open Shaded Limestone / Dolostone Cliff Face Type	X	X	G5	S3	C	A	A	
			Canada Bluegrass Open Unshaded Limestone / Dolostone Cliff Face Type	X	X	G5	S3	C	A	A	
			Open Limestone / Dolostone Seepage Cliff Type	(X)	(X)	G?Q	S3	C	A	A	
			Open Limestone / Dolostone Cliff Rim Type	X	X	G5	S2	B	A	A	
			Limestone / Dolostone Cliff Shrubland Ecosite								
			Common Juniper Open Limestone / Dolostone Cliff Rim Shrubland Type	X	(X)	G?	S2S3	BC	A	A	
			Round-leaved Dogwood Open Limestone / Dolostone Cliff Rim Shrubland Type	X	X	G?	S3	C	A	A	
			Treed Limestone / Dolostone Cliff Ecosite								
			White Cedar Treed Limestone Cliff Type	X	X	G2Q	S3	C	AB	A	
			Sugar Maple - Ironwood - White Ash Treed	X	X	G?	S3	C	AB	A	
			White Birch - Aspen Treed Limestone Cliff Type	X	X	G?	S3S4	C	B	A	
			Open Sandstone Cliff Ecosite	(X)		G?Q	S1	AB	A	C	
			Sandstone Cliff Shrubland Ecosite	(X)		G?Q	S1	A	A	C	may not occur in 6e and 7e
			Treed Sandstone Cliff Ecosite	(X)		G?Q	S1	AB	A	C	may not occur in 6e and 7e
			Open Granite Cliff Ecosite								
			Moist Moss - Liverwort Granite Cliff Face Type	X		G4Q	S4	D	AB	D	

Natural Heritage Information Centre
Community Type Provincial Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Granite Cliff Shrubland Ecosite	(X)		G?	S4	D	AB	D	
			Treed Granite Cliff Ecosite	(X)		G?	S4S5	D	BC	D	
		Talus									
			Open Limestone / Dolostone Talus Ecosite								
			Dry Herbaceous Limestone / Dolostone Talus	X	X	G?	S2	B	A	A	
			Wet Herbaceous Limestone / Dolostone Talus	(X)	(X)	G?	S2	B	A	A	
			Limestone / Dolostone Talus Shrubland								
			Round-leaved Dogwood Open Limestone / Dolostone Talus Shrubland Type	X	X	G?	S2S3	BC	A	A	not as rich or diverse, and more disturbed than Mountain Maple Type
			Mountain Maple Open Limestone Talus Shrubland Type	X	X	G?	S3	C	A	A	richer sites, more diverse and less disturbed than above
			Treed Limestone / Dolostone Talus Ecosite								
			White Birch Dry Treed Limestone Talus Type	X	X	G3G5	S3	C	B	A	
			White Cedar Dry Treed Limestone Talus Type	X	X	G?	S3	C	B	A	
			Sugar Maple Moist Treed Limestone Talus Type	X	X	G3G5	S3	C	B	A	
			Basswood - White Ash - Butternut Moist Treed Limestone Talus Type	X	(X)	G3G5	S2	B	A	A	
			Hemlock - Sugar Maple Moist Limestone Talus Type	X	X	G?	S2	B	A	A	
			Open Sandstone Talus Ecosite	(X)		G4G5	S1	A	A	C	
			Sandstone Talus Shrubland Ecosite	(X)		G4G5	S1	A	A	C	
			Treed Sandstone Talus Ecosite	(X)		G4G5	S1	B	A	C	
			Open Granite Talus Ecosite	(X)		G4G5Q	S3S4	C	B	D	
			Granite Talus Shrubland Ecosite	(X)		G4G5Q	S3S4	C	B	D	
			Treed Granite Talus Ecosite	(X)		G4G5Q	S3S4	C	B	D	
		Crevice and Cave									
			Limestone / Dolostone Crevice Ecosite								
			Liverwort - Moss - Fern Limestone Crevice Type	X	(X)	G5	S4	D	A	A	includes crevices in limestone / dolostone barrens andalvars
			Limestone / Dolostone Solution Cave Ecosite	(X)		G?	S1	B	A	A	
			Limestone / Dolostone Crevice Cave Ecosite	(X)		G?	S1	B	A	A	
	Rockland										
		Open and Treed Rock Barren									
			Open Limestone/Dolostone Barren Ecosite								Rolling or uneven limestone reef bedrock, not flat alvar
			Dry Limestone/Dolostone Barren Type	X		G?	S2S3	AB	AB	B	
			Limestone / Dolostone Shrubland Barren Ecosite								
			Common Juniper Limestone / Dolostone Shrubland Barren Type	(X)		G?	S3	B	B	A	
			Round-leaved Dogwood Limestone / Dolostone	(X)		G?	S3	B	A	A	Likely a post-fire or logging relict
			Treed Limestone / Dolostone Barren Ecosite								
			Red Cedar Treed Limestone Barren Type	X		G?	S1	A	A	AB	
			HackberryTreed Limestone Barren Type	X		G?	S1	AB	A	AB	
			Oak Treed Limestone Barren Type	X		G?	S1	AB	A	AB	
			Open Sandstone Barren Ecosite								
			Dry Sandstone Barren Type	X	X	G?	S1	A	A	B	

W.D. Bakowsky

Natural Heritage Information Centre
Community Type Provincial
Ranks

System	Community Series		Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
	I	II									
			Sandstone Barren Shrubland Ecosite	(X)		G?	S1	A	A	B	
			Treed Sandstone Barren Ecosite	(X)	X	G?	S1	AB	A	B	
			Open Granite Barren Ecosite								
			Dry Granite Barren Type	X		G?	S5	D	CD	D	
			Granite Shrubland Barren Ecosite								
			Blueberry Granite Shrubland Barren Type	X		G?	S1	D	CD	D	
			Chokeberry Granite Shrubland Barren Type	X		G?	S3	C	AB	B	
			Common Juniper Granite Shrubland Barren Type	X		G?	S4	CD	BC	D	
			Treed Granite Barren Ecosite								
			Red Cedar Treed Granite Barren Type	X		G?	S1	AB	A	B	
			Pitch Pine Treed Granite Barren Type	X		G[illegible]G5	S1	A	A	B	
			Jack Pine Treed Granite Barren Type	X		G5	S5	D	D	D	
			Oak - Red Maple - Pine Treed Granite Barren Type	X		G?	S4S5	C	C	C	
		Alvar [illegible]									
			Open Alvar Ecosite								<10% tree cover
			Shrubby Cinquefoil - Creeping Juniper - Scirpus-like Sedge Alvar Pavement Type	X		G2?	S2	C	B	A	>50 % exposed pavement Bruce (and Manitoulin in Site Region 5E)
			Philadelphia Panic Grass - False Pennyroyal Alvar Pavement Type	X		G1Q	S1	A	A	A	>50 % exposed pavement Napanee, Burnt Lands, Carden
			Northern Dropseed - Little Bluestem - Scirpus-like Sedge Alvar Grassland Type	X		G2G3?	S2S3	C	B	A	>50% herbaceous species cover Bruce (and Manitoulin in Site Region 5E)
			Tufted Hairgrass - Canada Bluegrass - Philadelphia Panic Grass Alvar Grassland Type	X		G2G3?	S2S3	C	B	A	>50% herbaceous species cover Napanee, Burnt Lands, Carden drier portions of higher-quality examples may include areas dominated by Little Bluestem and/or Northern Dropseed
			Canada Bluegrass - Nodding Onion Alvar Grassland Type		X	G1?	S1	A	A	A	>50% herbaceous species cover Pelee Island only examples are disturbed by past grazing
			Alvar Shrubland Ecosite								> 25% shrub cover
			Common Juniper - Creeping Juniper - Shrubby Cinquefoil Alvar Shrubland Type	X		G2?	S2	B	AB	A	
			Common Juniper - Fragrant Sumac - Hairy Beardtongue Alvar Shrubland Type	X		G2?	S2	B	AB	A	
			Treed Alvar Ecosite								tree cover between 10% and 60%
			White Cedar - Jack Pine - Shrubby Cinquefoil Treed Alvar Pavement	X		G1G2	S1	B	A	A	>50% pavement
			Jack Pine - White Cedar - Low Calamint Treed Alvar Grassland Type	X		G1?	S1	B	A	A	>50% herbaceous species cover Bruce (and Manitoulin in Site Region 5E) all tree species not always present, may also have White Spruce, Tamarack
			White Cedar - White Spruce - Philadelphia Panic Grass Treed Alvar Grassland Type	X		G3?	S3	C	B	A	>50% herbaceous species cover Carden, Napanee, Burnt Lands
			Red Cedar - Early Buttercup Treed Alvar Grassland Type	X		G2?	S2	B	B	A	>50% herbaceous species cover Napanee
			Chinquapin Oak - Nodding Onion Treed Alvar Grassland Type		X	G1?	S1	A	A	A	>50% herbaceous species cover Pelee Island only examples have been disturbed by past grazing
			Shagbark Hickory - Prickly Ash - Philadelphia Panic Grass Treed Alvar Grassland Type		X	G1Q	S1	A	A	A	Flamborough
			Jack Pine - White Cedar - Common Juniper Treed Alvar Shrubland Type	X		G2?	S2	B	AB	A	>25% shrub cover Bruce (and Manitoulin in Site Region 5E) occasionally White Spruce or White Birch dominate
	[illegible]										
		[illegible]									
			Sand Barren Ecosite								
			Bracken Fern Sand Barren Type	X		G?	S2	B	A	B	reported from Trent River area
			Hay Sedge Sand Barren Type	X		G?	S1	A	A	B	Carex siccata (C. foenea), reported from Trent River area
			Slender Wheat-grass Sand Barren Type	X		G?	S1	A	A	B	Elymus trachycaulus (Agropyron trachycaulum)

Natural Heritage Information Centre
Community Type Provincial Ranks

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
		Tallgrass Prairie, Savannah & Woodland									
			Dry Tallgrass Prairie Ecosite								
			Dry Tallgrass Prairie Type	X	X	G3	S1	B	A	B	few extensive (> 2 ha) remnants known
			Moist - Fresh Tallgrass Prairie Ecosite								
			Moist - Fresh Tallgrass Prairie Type		X	G2	S1	B	A	A	few extensive (> 2 ha) remnants known
			Dry Tallgrass Savannah Ecosite								
			Dry Black Oak Tallgrass Savannah Type		X	G3	S1	A	A	B	ca. 400 ha at Pinery, very little elsewhere
			Dry Black Oak-Pine Tallgrass Savannah Type	(X)	X	G?	S1	A	A	B	ca. 400 ha at Pinery, also at Wasaga, Turkey Pt.
			Moist - Fresh Tallgrass Savannah Ecosite								
			Moist - Fresh Pin Oak - Bur Oak Tallgrass Savannah Type		X	G1	S1	A	A	A	< 1000 ha
			Moist - Fresh Black Oak Tallgrass Savannah Type		X	G2	S1	A	A	A	< 1000 ha
			Dry Tallgrass Woodland Ecosite								
			Dry Black Oak - White Oak Tallgrass Woodland Type		X	G?	S1	A	A	A	< 1000 ha
			Dry Bur Oak - Shagbark Hickory Tallgrass Woodland Type	X		G?	S1	A	A	A	occurs on fairly shallow soils (ca. 20-30 cm depth) over limestone, a.k.a. limestone woodland
			Moist - Fresh Oak Tallgrass Woodland Ecosite								
			Moist - Fresh Black Oak - White Oak Tallgrass Woodland Type		X	G2	S1	AB	A	A	< 1000 ha
			Moist - Fresh Pin Oak Tallgrass Woodland Type		X	G1	S1	AB	A	A	< 1000 ha
		Deciduous Forest									
			Dry Deciduous Forest Ecosite								
			Dry Oak - Hickory Deciduous Forest Type	X	X	G4?	S3S4	CD	BC	A	
			Dry Black Oak Deciduous Forest Type	(X)	X	G4?	S3	C	BC	A	
			Dry - Fresh Oak Deciduous Forest Ecosite								
			Dry - Fresh Red Oak Deciduous Forest Type	X	X	G?	S5	D	D	BC	
			Dry - Fresh White Oak Deciduous Forest Type	X	X	G?	S4	D	CD	BC	
			Dry - Fresh Mixed Oak Deciduous Forest Type	X		G?	S3S4	CD	C	BC	
			Dry - Fresh Oak - Maple Deciduous Forest Type								
			Dry - Fresh Oak - Sugar Maple Deciduous Forest Type	X	X	G?	S5	D	D	B	
			Dry - Fresh Oak - Red Maple Deciduous Forest Type	X	X	G?	S5	D	D	B	
			Dry - Fresh Hackberry Deciduous Forest Ecosite								
			Dry - Fresh Hackberry Deciduous Forest Type		X	G?	S2	BC	A	A	found on calcareous sites
			Dry - Fresh Hickory Deciduous Forest Ecosite								
			Dry - Fresh Hickory Deciduous Forest Type	X	X	G4?	S3S4	CD	BC	A	
			Dry - Fresh White Birch - Poplar - Aspen - White Ash Deciduous Forest Ecosite								
			Dry - Fresh White Birch Deciduous Forest Type	X	X	G4?	S5	D	D	D	
			Dry - Fresh Aspen - Poplar Deciduous Forest Type	X	X	G5	S5	D	D	D	
			Dry - Fresh White Ash Deciduous Forest Type	X	X	G?	S5	D	D	D	
			Dry - Fresh Sugar Maple - Mixed-Deciduous Forest Ecosite								
			Dry - Fresh Sugar Maple - Oak Deciduous Forest Type	X	X	G?	S5	D	D	C	
			Dry - Fresh Sugar Maple - Ironwood Deciduous Forest Type	X	(X)	G?	S5	D	D	C	
			Dry - Fresh Sugar Maple - Hickory Deciduous Forest Type		X	G?	S4	D	CD	B	
			Dry - Fresh Sugar Maple - Basswood Deciduous Forest Type	X	X	G?	S5	D	D	B	

**Natural Heritage Information Centre
Community Type Provincial
Ranks**

System	Community Series		Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
	I	II									
			Fresh Sugar Maple - Beech Deciduous Forest Ecosite								
			Fresh Sugar Maple Deciduous Forest Type	X	X	G5?	S5	D	D	C	
			Fresh Sugar Maple - Beech Deciduous Forest Type	X	X	G5?	S5	D	D	C	
			Fresh Beech Deciduous Forest Type		X	G4G5	S4S5	D	D	C	
			Fresh Sugar Maple - Mixed-Deciduous Forest Ecosite								
			Fresh Sugar Maple - White Ash Deciduous Forest Type	X	X	G?	S5	D	D	C	
			Fresh Sugar Maple - Red Maple Deciduous Forest Type	X	X	G?	S5	D	D	C	
			Fresh Sugar Maple - White Birch - Aspen Deciduous Forest Type	X	X	G5	S5	D	D	C	
			Moist - Fresh Sugar Maple - Mixed-Deciduous Forest Ecosite								
			Moist - Fresh Sugar Maple - Lowland Ash Deciduous Forest Type	X	X	G?	S5	D	D	C	
			Moist - Fresh Sugar Maple - Black Maple Deciduous Forest Type	X	X	G?	S3?	BC	AC	A	found on dry sites and river terraces, many reports of Black Maple misidentified, hybridizes with Sugar Maple
			Moist - Fresh Sugar Maple - Yellow Birch Deciduous Forest Type	X	X	G5?	S5	D	D	C	
			Moist - Fresh Sugar Maple - White Elm Deciduous Forest Type	X	X	G?	S5	D	D	C	
			Moist - Fresh Black Walnut Deciduous Forest								
			Moist - Fresh Black Walnut Deciduous Forest Type		X	G4?	S2S3	C	A	A	
			Moist - Fresh Hackberry Deciduous Forest Ecosite								
			Moist - Fresh Hackberry Deciduous Forest Type		X	G4?	S2	B	AB	A	occur on calcareous sites
			Moist - Fresh White Birch - Aspen - Poplar - Deciduous Forest Ecosite								
			Moist - Fresh White Birch Deciduous Forest Type	X	X	G4?	S5	D	D	D	
			Moist - Fresh Aspen - Poplar Deciduous Forest Type	X	X	G5	S5	D	D	D	
		Mixed Forest									
			Dry Oak - Pine Mixed Forest Ecosite								
			Dry Oak - Pitch Pine Mixed Forest Type	X		G?	S1	B	AB	A	Pitch Pine stands declining due to fire suppression
			Dry Chinquapin Oak - Pine Mixed Forest Type		X	G3Q	S2	B	AB	A	
			Dry - Fresh White Pine Mixed Forest Ecosite								
			Dry - Fresh White Pine - Oak Mixed Forest Type	X	X	G4G5	S5	D	D	C	
			Dry - Fresh White Pine - Red Maple Mixed Forest Type	X	(X)	G4G5	S5	D	D	C	
			Dry - Fresh White Pine - Sugar Maple Mixed Forest Type	X	X	G?	S5	D	D	C	
			Dry - Fresh White Cedar Mixed Forest Ecosite								
			Dry - Fresh White Cedar - White Birch Mixed Forest Type	X	X	G4G5Q	S5	D	D	D	
			Dry - Fresh White Cedar - Aspen Mixed Forest Type	X	(X)	G4G5Q	S5	D	D	D	
			Dry - Fresh White Birch - Aspen Mixed Forest Ecosite								
			Dry - Fresh Aspen Mixed Forest Ecosite	X	(X)	G5	S5	D	D	D	
			Dry - Fresh White Birch Mixed Forest Ecosite	X	X	G4G5Q	S5	D	D	D	

System	Community Series I	Community Series II	Ecosite	6E	7E	Global Rank	Provincial Rank	Estimated # EO's	EO Abundance	EO Range	Comments
			Moist - Fresh Hemlock Mixed Forest Ecosite								
			Moist - Fresh Hemlock - Sugar Maple Mixed Forest Type	X	X	G4G5	S4S5	D	CD	C	
			Moist - Fresh Hemlock - White Birch Mixed Forest Type	X	X	G4G5	S4S5	D	CD	C	
			Moist - Fresh White Cedar Mixed Forest Ecosite								
			Moist - Fresh White Cedar - Birch - Aspen Mixed Forest Type	X	X	G5Q	S5	D	D	D	
			Moist - Fresh White Cedar - Sugar Maple Mixed Forest Type	X	X	G5Q	S5	D	D	D	
			Moist - Fresh White Birch - Aspen Mixed Forest Ecosite								
			Moist - Fresh White Birch - Aspen Mixed Forest Type	X	X	G5Q	S5	D	D	D	
		Coniferous Forest									
			Dry Coniferous Forest Ecosite								
			Dry Jack Pine Coniferous Forest Type	X		G4G5	S5	D	D	D	
			Dry Red Pine - White Pine Coniferous Forest Type	X	X	G3G4	S4	C	CD	C	
			Dry Red Cedar Coniferous Forest Ecosite								
			Dry Red Cedar Coniferous Forest Type	X	X	G?	S4	CD	BC	A	
			Dry - Fresh White Pine Coniferous Forest Ecosite								
			Dry - Fresh White Pine Coniferous Forest Type	X	X	G3G4	S4S5	D	C	C	
			Dry - Fresh White Cedar - White Spruce Coniferous Forest Ecosite								
			Dry - Fresh White Cedar Coniferous Forest Type	X	X	G4	S5	D	D	D	
			Dry - Fresh White Spruce Coniferous Forest Type	X		G4	S5	D	D	D	
			Fresh Hemlock Coniferous Forest Ecosite								
			Fresh Hemlock Coniferous Forest Type	X	X	G4?	S4S5	D	BC	C	
			Fresh Hemlock - Mixed Coniferous Forest Type	X	X	G3G4Q	S4S5	D	BC	C	
			Moist - Fresh White Cedar - Mixed - Coniferous Forest Ecosite								
			Moist - Fresh White Cedar - Hemlock Coniferous Forest Type	X	X	G4?	S5	D	D	D	
			Moist - Fresh White Cedar - Balsam Fir Coniferous Forest Type	X		G4	S5	D	D	D	

APPENDIX K

Significant Wildlife Habitat: Waterfowl Component (ducks, geese and swans)

The significant waterfowl habitats described in this appendix were developed by a working group formed at a significant wildlife habitat workshop held in January 1996. The working group membership included representatives of the Ministry of Natural Resources, Canadian Wildlife Service, Ducks Unlimited and private consultants. The group also included researchers and field staff. The group met on several occasions and produced the report that makes up this appendix.

1. Conservation of Significant Waterfowl Habitat

Goal:

Ontario has a rich diversity of waterfowl species and the intent is that none of them shall be permitted to undergo sustained decline because of development-related loss of habitat or degraded habitat functions.

(Eleven waterfowl species that inhabit Ontario currently have populations that are below the goals established in the North American waterfowl Management Plan for 2001: Mallard, Pintail, Wigeon, Green-winged Teal, Blue-winged Teal, Canvasback, Scaup, Southern James Bay Canada goose, Mississippi Valley Canada goose and Atlantic Brant)

(In some southern Ontario landscapes, wetland losses range from 78 % to 87 %)

(There is no estimate of the extent of degradation that settlement activities have had on wetland functions)

Objectives:

Identify and protect all waterfowl habitat of significance in the municipality.

(Only 18 % of the municipalities in southern Ontario have no mapped wetlands)

Ensure policies do not prevent management and restoration of wetlands.

(In a sample of 40 counties across southern Ontario, there are over 1.6 million ha of soils that are poorly drained, very poorly drained, bottomlands, organic or marshes that may need restoration or management to retain functions)

2. General Principles

All migratory species are potentially important at different scales.

Migratory wildlife are significantly different from sedentary species when it comes to habitat issues: no one jurisdiction encompasses the habitats required for their survival. Consequently, cooperation is needed at local, regional, provincial, national and even international levels to protect and enhance their habitat needs.

The entire suite of waterfowl habitats must be considered, including those that lie outside of wetlands. Agricultural practices that provide or promote ephemeral waterfowl habitats or functions (wet areas in farmed locations) should be encouraged.

Waterfowl are a group of 32 species that use Ontario habitats for migration, staging, breeding, moulting, and in some cases, wintering. They depend on the following types of habitat to accommodate their needs over the course of their life cycle: pre-laying feeding habitat (usually ephemeral; include temporary pools, sheetwater, meltwater particularly on croplands during spring migration before machinery can access); nesting habitat; brood-rearing habitat; moulting areas; local roosts; staging habitat; and wintering habitat.

Habitats which are used by waterfowl that are rarely found in Ontario should be considered because of their contribution to the biological diversity of those sites.

For waterfowl, the issue of rarity is best dealt with by considering site biodiversity. Normally, waterfowl are rare only because a small portion of their North American range includes Ontario. They may be abundant elsewhere. Their unique value should be recognized as a contribution to diversity rather than a rarity.

Planning controls should not prevent wetland management or restoration.

Most wetland sites in southern Ontario are degraded and require management to restore functions.

3. Specific Habitats

The habitat of significant species can be identified by two categories: locations that are known and mapped; and locations that are unknown and must be mapped on the basis of population status and landform preference.

a) Known and Mapped Locations

The following sites are significant for waterfowl:

- Long Point;
- lower Detroit River;
- Hillman/Point Pelee
- Amherst Island;
- Hullett PWA;
- Minesing Swamp;
- Matchedash Bay PWA;
- Lake St. Francis;
- Presqu'ile Bay;
- Lake St Clair;
- Wolfe Island;
- Rondeau Bay;
- St. Lawrence River;
- Luther Marsh PWA;
- Tiny Marsh PWA;
- Wye Marsh PWA;
- Prince Edward County shores;
- Lake Scugog;

. Cache Bay;
. Lake of the Woods;
. Nighthawk Lake; and
. west Rainy Lake;
. Little Claybelt;
. Holland/Scanlon Marshes.

(Sources for this information include Environment Canada - Canadian Wildlife Service, Ontario Ministry of Natural Resources, Ducks Unlimited Canada and local Conservation Authorities)

b) Unknown and Unmapped Locations

Knowledge of two factors are useful in mapping local sites of potentially significant waterfowl habitat: the population status of the waterfowl species normally expected to inhabit the municipality and the location of landforms that characterize their habitat preferences.

These 5 categories are useful in describing the population status of the waterfowl that could be present in Ontario municipalities:

Categories for Waterfowl Population Status	**Applicable Species or Populations (1995 Data)**
A) Species whose populations are in decline	Black Duck, Southern James Bay & Atlantic populations of Canada goose
B) Species for which Ontario provides a large portion of their continental breeding and staging habitat	Common Goldeneye, Canvasback, Redhead, Ringnecked Duck, Scaup (2 species),Hooded Merganser, Old Squaw, Scoters (3 species), Mississippi Valley & Southern Ontario Canada goose
C) Species for which Ontario provides an important component of continental breeding and staging habitat	Wood Duck, Merganser (2 species) Coot, Wigeon, Gadwall, Blue-winged Teal, Green-winged Teal, lesser Snow goose, Mallard
D) Species for which breeding, staging and wintering habitat is limited in Ontario	Ruddy Duck, King & Common Eider, Trumpeter Swan, Atlantic Brant
E) Species that are dependant on transitory habitats	Pintail, Tundra Swan, Shoveller

(Sources of this information include Environment Canada - Canadian Wildlife Service and the Ontario Ministry of Natural Resources)

The following landforms characteristically provide significant waterfowl habitat and need to be examined:

Landform Type	**Measures of Significance**
Wetlands	• Type of wetland: using the definitions in the Provincial Wetlands Classification System, marshes and swamps are more important than bogs or fens • Size of wetland: small wetlands (based on confirmed boundaries) are important but as wetland size increases, so do the local values - larger may be better in some municipalities • Groups of wetlands: clusters of wetlands (more than 10 within 1,000 m of the centre of each) are more important than single wetlands • Peripheral lands: uplands, such as grass and shrub habitats, as well as pastureland within a significant distance can provide important nesting habitat
Poorly Drained Landscapes	• Stream & Riverine Bottomlands: floodlands provide important waterfowl habitat • Soils: certain soil types (ie. Farmington series as determined by soil maps or Ontario land Inventory maps) are useful indicators of important habitat. • Potholes: terrain with over 50 small wetlands per sq. km. are important waterfowl habitats • Beaver Ponds: terrain with over 25 ponds per 10 sq. km. are important habitats • Seasonal Wet Locations: seasonally flooded locations, even those under active cultivation, such as sheetwater or meltwater areas and poorly drained croplands provide seasonally important pre-nesting habitat
NAWMP Project Sites	These wetland enhancement locations are undertaken only on important waterfowl habitats
Coastal Marshes	The shores of Great Lakes and other large inland lakes provide uncommon but valuable locations for breeding and staging waterfowl

(Sources of this information include Environment Canada - Canadian Wildlife Service, the Ontario Ministries of Agriculture, Food and Rural Affairs and Natural Resources, Ducks Unlimited Canada, Conservation Authorities, agricultural associations and farm, naturalist, hunter and trapper clubs)

By combining the category for each waterfowl species known to be present in the municipality with mapped landform information and the knowledge of interest groups, the local significance of waterfowl habitats can be determined.

3. Impacts from Development

There are three impacts that residential, commercial and industrial development has on significant waterfowl habitats (see the 5 types in section 3b):

. loss of area and function;
. degradation of wetland functions and values; and
. fragmentation from surrounding natural landscapes.

These impacts operate more commonly in urban environments because they result in permanent changes to waterfowl habitat.

In rural environments, even those under active cultivation, the changes to waterfowl habitat are normally temporary and compensatory. Major drainage schemes and large-scale clearing efforts are the exceptions. Such techniques as crop rotation, grassed waterways, conservation tillage, buffer strips, living fencelines, windbreaks, rotational grazing and contour ploughing only shift the location of transitory habitat types - they do not permanently destroy them - particularly if they are practice within 300 m of traditional habitats.

If existing habitats are not destroyed, it allows for future restoration at appropriate times and locations.

APPENDIX L

Practical Approach for Identifying and Mapping Rare Vegetation Communities Using the Southern Ontario Ecological Land Classification Approach

Introduction

The identification and protection of rare vegetation communities within a planning area is important. Frequently these areas support numerous provincially or regionally rare species. Many plant and animals species depend on rare vegetation communities because they provide critical habitat found nowhere else. On a larger scale, they serve to maintain overall biodiversity; on a smaller scale, they contribute to healthy wildlife populations in the planning area.

While some of these communities have never been common in Ontario, many others have been lost or severely degraded, particularly in southern Ontario. The program and the efforts of researchers and naturalists have helped to identify many of the rare vegetation communities in Ontario. Planning authorities across southern Ontario, using the provincial ELC approach, can further help to identify and then protect these important natural areas.

ELC and the Vegetation Communities of Ontario

The vegetation communities of Ontario can be surveyed and classified using a process called Ecological Land Classification (ELC). The ELC is the process of arranging or ordering information about land units to better understand their similarities and relationships. The goal of the provincial ELC program is to establish a comprehensive and consistent province-wide approach for ecosystem description, classification, mapping, and data collection. It helps to identify recurring ecological patterns on the landscape to reduce complex natural variation to a reasonable number of meaningful ecosystem units. The ELC framework is being designed to facilitate key conservation, planning, and ecosystem management objectives, at various site to landscape scales of resolution. It will provide community descriptions and sampling methodologies for identifying and mapping valuable natural heritage features and areas. This will help municipalities to meet their obligations under the new system of planning in Ontario as outlined in Policy 2.3 in the Provincial Policy Statement.

The vegetation communities identified by the ELC process are developed through extensive collection and statistical analysis of primarily field data. To date, a complete range of forest communities for northern and central Ontario, and wetland communities for the northwestern part of the province have been identified. In southern Ontario, the ELC is still being developed, but during the interim, existing data have been used to develop a preliminary ecological land classification for southern Ontario. This classification is described in a 1998 publication entitled *Ecological Land Classification for Southern Ontario: First Approximation and its Application.*

Organization and brief explanation of the ELC framework
There are 6 levels to the ELC arranged in a hierarchy. They are explained in the manual *Ecological Land Classification for Southern Ontario: First Approximation and Its Application* and vegetation and environmental characteristics are listed for each one. From the largest to the smallest scale they are:

1. Site Region. The ELC for Southern Ontario applies to Site Regions 6E and 7E.
2. System: Aquatic, Wetland, Terrestrial. The manual provides a key to determine the type of System.
3. Community Class. Ultimately the division of Community Classes is based on recurring patterns in plant species associations that have shared physiognomic characteristics, substrate type, geology, and meso- and microclimate, as well as other ecological factors.
4. Community Series. These units are normally visible and consistently recognizable on aerial photographs or from a combination of maps, aerial photograph interpretation, and other remote sensing techniques. Community Series are the lowest level in the ELC that can be identified without a site visit. They are distinguished based on the type of vegetation cover or the plant form that characterizes the community. Generally, they are identified based on whether the community has open, shrub, or treed vegetation cover, as well as whether the plant form is deciduous, coniferous, or mixed.
5. Ecosite. This landscape unit represents recurring vegetation and soil types. The manual provides a key to determine the type of Ecosite.
6. Vegetation Type. This is the finest level of resolution in the ELC hierarchy. Vegetation Types are recurring patterns found in plant species assemblages associated with a particular Ecosite. They are generated by grouping plant communities that are most similar together, based entirely on the plant species composition.

The Ontario Ministry of Natural Resources, Credit Valley Conservation Authority and a private consultant have developed a description framework, field sampling methods, an integrated database, and a manual that might be useful to southern municipalities interested in identifying and describing the vegetation communities within their jurisdiction. The following information is provided below to help municipalities identify and map vegetation communities, especially those that may be rare.

Rare vegetation communities
The ultimate objective is to identify and accurately map the rare vegetation communities found in the planning area. The methods outlined below can be used to identify and map the ELC units at a variety of scales. The list of rare vegetation communities for Site Regions 6E and 7E are listed in Appendix M. A planning authority may wish first to classify all of the land within its jurisdiction and later focus on the rare communities, or it may decide to concentrate only on the rare vegetation communities.

Remote methods such as aerial photograph interpretation, can normally be used to reliably identify vegetation communities to the Community Series level of the ELC hierarchy. However most rare vegetation communities (see Appendix J) have been identified at the Vegetation Type level, the finest scale in the ELC hierarchy. Field investigations are required to reliably identify both the Vegetation Types and Ecosites as information must be collected on soil and site conditions, as well as specific indicator vegetation species.

The identification of the Community Series can be an important first step in the screening process to identify rare vegetation communities because it can indicate where there is a high probability of finding a rare Vegetation Type and where field investigations should be focused. For example, the identification of the Tallgrass Savannah Community Series will indicate the presence of rare vegetation communities because all of the Vegetation Types under this Community Series are rare (see Appendix J). In other situations the identification of the Community Series will not readily indicate the location of the rare vegetation Types. For example, there are 27 Thicket Swamp Types under the Thicket Swamp Community Series (see Appendix J). Of these, 7 Vegetation Types are considered rare (i.e., S1 to S3). Two of them, Paw-paw Mineral Thicket Swamp and Huckleberry Organic Thicket Swamp (only found in one location) are very rare (i.e., S1).

It requires considerable botanical knowledge to identify some of these Vegetation Types, comprised of such species as Buttonbush, Southern Arrow-wood and Spicebush. However, knowing the distribution and preferred habitat of species (see Appendix G) can make it easier. Also lists of species that often are included in wetland evaluations, natural area inventories, site management plans, and consultant reports may assist in locating some of these species and rare vegetation communities.

Many, but not all rare vegetation communities have already been identified and mapped (see Appendix M). The information in Appendix M provides general locations of rare vegetation communities and can be used to identify areas where there may be additional examples of these communities.

Limitations of the ELC

The ELC is becoming the accepted framework for natural community description in Ontario and rare vegetation communities for Site Regions 6E and 7E have been identified and described based on the *Ecological Land Classification for Southern Ontario: First Approximation and Its Application*. However, there are some challenges when using the ELC and they are outlined below.

- At the present time, the ELC for Southern Ontario and the 1998 OMNR manual only apply to Site Regions 6E and 7E, an area roughly enclosed by the Ontario-Quebec border, along the north shores of Lake Ontario and Lake Erie, up the eastern shoreline of Lake Huron to the tip of the Bruce Peninsula, around Georgian Bay to Midland, and eastward through Orillia, Marmora, to Arnprior. See Figure 2-1 (site regions). This area does not include Manitoulin Island.

- The ELC for southern Ontario, based on new data collection and analysis, has only been completed for forest land. However, it will be expanded to include wetlands. In the interim, the first approximation provides an excellent source of information.

- It can be difficult to determine whether a vegetation community is rare and some communities do not fit easily into the ELC description. Often this is because most natural communities in southern Ontario have been disturbed either directly or indirectly by people. Many communities may have some species that are indicators of a potentially rare community (e.g., some prairie grasses) but lack other key species. Or they may be comprised of a few indicator species and many invasive, exotic species. The site might have once supported a relatively pristine community, but become somewhat degraded or otherwise altered due to changes in land use. Sometimes difficult decisions are required to determine the status of these communities. As a general rule, they should be based on the rarity of the remnant community and the efforts required to restore it. There are a growing number of examples of successful tall-grass prairie restoration projects and remnants of other rare vegetation communities could be restored as well.

- It can be difficult to accurately map small vegetation communities. A minimum polygon size of 0.5 hectare is a feasible mapping unit for applying the ELC at a scale of 1:10,000. A polygon is a discrete and unique area outlined on a map or aerial photograph that contains more or less homogeneous environmental and vegetation characteristics. A hand-held GPS unit might help to accurately locate some small communities.

- Effective application of the ELC for Southern Ontario requires skilled field workers with a good knowledge of plants and soil characteristics. Some vegetation communities are quite difficult to describe because they are complex or disturbed to varying degrees.

- Training of field staff (e.g., instruction on aerial photograph interpretation, soil description, ELC field sampling methodology) might be required if the municipality would prefer to develop in-house knowledge and familiarity with the ELC.

- Aerial photograph interpretation is a skill that takes considerable practice to develop. Also the planning authority cannot assume that private consultants have this skill.

- Application of the ELC is potentially expensive because of the volume of information that must be collected during field visits. Field investigations will usually be required to find rare vegetation communities, thus increasing overall costs. Even while working at the landscape scale, a very brief site reconnaissance may be advisable to verify initial community typing obtained from aerial photographs, confirm boundaries, become familiar with the level of variation found within the community,

- or to check unusual features. This limited ground-truthing allows the photograph interpreter to develop a finer appreciation of the differences between the photograph and the communities on the ground.

How to apply ELC tools and techniques to identify rare vegetation communities for land use planning
The following table provides a brief summary of how the ELC might be applied at both the larger landscape scale and the smaller site scale to achieve several important objectives. The tools and techniques, as well as explanations of them and the ELC terminology (e.g., landform, slope position, vegetation form and cover) and Description Framework are fully explained in the manual *Ecological Land Classification for Southern Ontario: First Approximation and Its Application*. Also included in the manual are examples of the ELC Field Sampling Methods and Data Cards.

Table L-1: How to apply ELC tools and techniques to identify rare vegetation communities

Objective	Landscape Scale	Site Scale
Delineation of the boundaries of potentially rare vegetation communities	• use aerial photographs, topographical, physiographic, soils &/or other maps & any other pertinent information (e.g., Arnup & Racey 1996 for details on how to interpret aerial photographs) to discern prominent landforms, slope position, drainage pattern, & vegetation form & cover to help to delineate the natural ecological or anthropogenic boundaries of potentially rare vegetation communities	• same as for landscape scale but also will also include gathering additional information in the field to help further determine boundaries of the rare community • look for additional communities within the site based primarily on changes in site conditions & vegetation and delineate their natural or anthropogenic boundaries
Field survey of potentially rare vegetation communities	• select one or more potentially rare communities identified from the sources above • from this list, first visit those with the greatest potential to exhibit rarity for the planning area & use the ELC Field Sampling Methods & Data Cards to collect the necessary data to describe & classify them according to the ELC • where necessary, refine earlier interpretations conducted before this field survey	• conduct more intensive field investigations of priority sites &/or sites for which more information is required • collect detailed site & vegetation data for each of these sites using the ELC Field Sampling & Data Cards
Description of potentially rare vegetation communities	• use the ELC Description Framework to describe the environmental, physical, historical, & vegetation conditions found on the site • use other sources of information to help to complete the Description Framework	• same as for landscape scale but necessarily includes more information collected during site visits
Classification of potentially rare vegetation communities	• use the information & data documented above to classify the site to the Community Class & Community Series levels in the ELC	• use information & data documented above to classify the site to Community Class, Community Series, Ecosite, & Vegetation Type levels in the ELC

Objective	Landscape Scale	Site Scale
	• use the ELC Keys & Community Tables to assign ELC units to the site • Note: only Community Class & Community Series level classifications can be achieved without a site visit	• use the ELC Keys & Community Tables to assign ELC units to the site • Note: only by using field data can a site be classified according to all the levels in the ELC
Mapping of potentially rare vegetation communities	• boundaries of rare communities & their corresponding classifications can be mapped by 1) manually transcribing the boundaries to hard-copy maps or 2) digitization into Geographical Information Systems (GIS) for digital mapping • mapping is to the Community Class or Community Series level in the ELC	• same as for the landscape scale, however mapping can be done to the Community Class, Community Series, Ecosite, & Vegetation Type level in the ELC

Basic equipment required to identify and map rare vegetation communities
The following list describes basic equipment required to identify and map rare vegetation communities.

- Maps, especially topographical, physiographical, soils, and Ontario Basic Mapping (OBM). Ontario Basic Mapping (OBM) is available in hard copy and digital format for all of southern Ontario at a scale of 1:10,000. It has become the standard for much of the natural areas mapping being carried out.

- Aerial photographs. Aerial photography varies considerably in scale, format, resolution, date, and seasonal coverage. However it forms the basis of most of the community mapping that is prepared. Aerial photographs available from the OMNR are mostly at 1:10,000. However if the planning authority wishes to use their own photos, it is suggested that they use those with a scale of 1:8,000 to facilitate interpretation. Also summer photography can be useful for the delineation of forested communities, if the expertise is available to differentiate species in the canopy of trees in full leaf. Spring photography would make areas of conifer and hardwoods, as well as waterbodies, woodland ponds, and flooded lands easier to see.

- A pocket stereoscope (2X magnification) is used for aerial photograph interpretation.

- Fine point technical pens (0.35 mm) are used to transcribe community boundaries directly onto the aerial photographs. Their ink can be erased.

- Although the manual *Ecological Land Classification for Southern Ontario: First Approximation and Its Application* was designed to produce an ecological land classification of communities for southern Ontario, it can be useful for identifying rare vegetation communities as well. It provides a description of the site, vegetation, and community characteristics that need to be sampled on a site, for the detailed description, identification, and classification of ecological land units in southern Ontario. It also provides details on how to sample characteristics, and a set of standardized data cards that can be used to record the collected information.

- A soil auger or Oakfield Tube to sample soils.

- Field guides for vascular plants to aid in plant identification.

- A plant press for collecting plants that require future identification.

- A Wedge Prism with a 2X prism factor to determine forest stand composition and basal area.

- Copies of information/data collection forms: ELC Community Description & Classification; ELC Stand & Soil Characteristics; ELC Plant Species List; ELC Management/Disturbance; and ELC Wildlife forms (sample copies are included in *Ecological Land Classification for Southern Ontario: First Approximation and Its Application*).

- There are several ways to transfer community boundaries interpreted from aerial photographs, to the OBMs. Boundaries can be drawn on mylar overlays placed on top of aerial photographs. The overlays are then transferred to the OBMs and boundaries can be traced onto the maps. This method is not recommended because of the discrepancy of scales between photographs and OBMs. They can also be transferred mechanically using a Sketchmaster. A Sketchmaster is one of the more common reflection instruments used for manually transferring information from single vertical aerial photographs to maps of a different scale. Boundaries can also be electronically transferred through digitization directly from ortho-rectified aerial photographs (i.e., photographs that have been corrected for distortion). Increasingly, digital aerial photographs on compact discs are being used, providing benefits such as the ability to change scales, and store line files.

- A dot grid and planimeter are used to calculate land cover area and percentage cover.

Information that must be collected

Data collection during field investigations is critical to accurate identification and mapping of potentially rare vegetation communities. But due to budget and time constraints, staffing expertise, time of year or other variables, it is not always possible to collect all the information outlined in the manual *Ecological Land Classification for Southern Ontario: First Approximation and Its Application*. Nevertheless, the following information should always be collected during a site visit to a potentially rare community.

- In forests and woodlands, forest stand characteristics; for other communities, the dominant species of vegetation. A small glass Wedge Prism is used to determine the forest stand composition and basal area of the site. Information about the vegetation composition of a site is mandatory for site classification.

- Soil characteristics. A soil auger or Oakfield tube is used to sample a soil core to ultimately determine soil texture, depth of organic layer, depth to bedrock, soil moisture, and soil drainage regime of the polygon. This information is also of fundamental importance to the classification system. For example, sugar maple-beech may be a common forest cover type within the planning area, but if it is found on very shallow (e.g., less than 15 cm) sandy soils, it might represent a rare vegetation community.

- Location of the site and its boundary. This is required for accurate mapping (and protection) of the potentially rare vegetation community.

APPENDIX M

Locations of Known Rare Vegetation Communitiies in Ontario

The Ministry of Natural Resources Natural Heritage Information Centre (NHIC) tracks the status and occurrences of rare vegetation communities in Ontario. The table that makes up this appendix, indicates the upper tier municipalities where rare vegetation communities are known to occur. The numbers indicate the numbers of known occurrences and an "x" denotes that the community is known to occur.

The table indicates the rarity of the vegetation community, which is represented by the S-rank (described in Appendix J) and G-rank (which denotes global rarity).

The Southern Ontario ELC Code and EL Code are listed in order to cross reference the communities listed with the NHIC and those described by the Ecological Land Classification System.

S. ONT ELC CODE	ELCODE	COMMON NAME	GRANK	SRANK	BRANT	BRUCE	DUFFERIN	DURHAM	ELGIN	ESSEX	FRONTENAC	GREY	HALDIMAND-NORFOLK	HALIBURTON	HALTON	HAMILTON-WENTWORTH	HASTINGS	HURON	KENORA	KENT	LAMBTON
ALO1-1	CEGL005192	Dry Lichen-Moss Open Alvar Pavement Type	G2	S1		3															
ALO1-2	CEGL005235	Dry Annual Open Alvar Pavement Type	G2	S1							1						X				
ALO1-3	CEON000218	Northern Dropseed - Little Bluestem - Scirpus-like Sedge Alvar Grassland Type	G2G3?	S2S3		14					X						X				
ALO1-4	CEON000225	White Cedar - White Spruce - Philadelphia Panic Grass Treed Alvar Grassland Type	G3?	S3		1					X						X				
ALO1-5	CEON000219	Tufted Hairgrass - Canada Bluegrass - Philadelphia Panic Grass Alvar Grassland Type	G2G3?	S2S3		5					1						3				
ALS1-1	CEON000222	Common Juniper - Fragrant Sumac - Hairy Beardtongue Alvar Shrubland Type	G2?	S2		3											2				
ALS1-2	CEON000221	Creeping Juniper - common Juniper - Shrubby Cinquefoil Alvar Shrubland Type	G2?	S2		6															
ALS1-3	CEON000216	Shrub Conifer - Dwarf Lake Iris Alvar Shrubland Type	G2?	S2		3															
ALT1-1	CEON000220	Chinquapin Oak - Canada Bluegrass - Nodding Onion Alvar Grassland Type	G1?	S1						1											
ALT1-2	CEGL005230	Shagbark Hickory - Prickly Ash Treed Alvar	G?	S?												1					
ALT1-3	CEON000229	Jack Pine - White Cedar - Common Juniper Treed Alvar Shrubland Type	G2?	S2		4															
ALT1-4	CEON000223	White Cedar - Jack Pine - Shrubby Cinquefoil Treed Alvar Pavement	G1G2	S1		5															
ALT1-5	CEON000226	Red Cedar - Early Buttercup Treed Alvar Grassland Type	G2?	S2													5				
BBO1-1	CEGL005162	Sea Rocket Sand Beach Type	G2G4	S2S3		X				6			X		X						X
BOS2-1	CEON000121	Leatherleaf Shrub Kettle Peatland Type	G3G4	S3	X	X						X	X		X			X			
CLO1-1	CEON000133	Cliffbrake - Lichen Open Unshaded Limestone / Dolostone Cliff Face Type	G5	S3		5	X					1			7	X					
CLO1-2	CEON000134	Bulblet Fern - Herb Robert Open Shaded Limestone / Dolostone Cliff Face Type	G5	S3		10	X					1			11	2					
CLO1-4	CEGL002048	Open Limestone / Dolostone Seepage Cliff Type	G?Q	S3			X								X	X					
CLO1-5	CEON000136	Open Limestone / Dolostone Cliff Rim Type	G5	S2		9	X					1			X	X					
CLS1-1	CEGL005066	Common Juniper Open Limestone / Dolostone Cliff Rim Shrubland Type	G?	S2S3		1															
CLS1-2	CEGL005070	Round-leaved Dogwood Open Limestone / Dolostone Cliff Rim Shrubland Type	G?	S3								1			1						
CLT1-1	CEGL002451	White Cedar Treed Limestone Cliff Type	G2Q	S3		2	X								11	X					
FET1-3	CEON000117	Gray Birch Treed Fen Type	G4?	S2S3																	
FOC4-2	CEON000103	White Cedar - Hemlock Coniferous Organic Swamp Type	G?	S3S4																	
FOD1-3	CEGL005030	Dry Black Oak Deciduous Forest Type	G4?	S3	2			X		1			1								X
FOD1-4	CEON000162	Dry - Fresh Mixed Oak Deciduous Forest Type	G?	S3S4									1								X
FOD2-2	CEON000159	Dry Oak - Hickory Deciduous Forest Type	G4?	S3S4	X					X					2						
FOD2-3	CEON000164	Dry - Fresh Hickory Deciduous Forest Type	G4?	S3S4						2							4				
FOD4-3	CEGL005021	Dry - Fresh Hackberry Deciduous Forest Type	G?	S2						16											
FOD6-2	CEON000178	Moist - Fresh Sugar Maple - Black Maple Deciduous Forest Type	G?	S3?					2						1		4				
FOD7-4	CEON000181	Moist - Fresh Black Walnut Deciduous Forest Type	G4?	S2S3																	
MAM2-8	CEON000022	Prairie Slough Grass Mineral Meadow Marsh Type	G2G3	S3		2															
MAM3-7	CEON000029	Prairie Slough Grass Organic Meadow Marsh Type	G2G3	S3		1															X
MAM4-1	CEON000016	Graminoid Coastal Meadow Marsh Type	G2?	S2		119			2		1		4							1	12
MAM4-2	CEON000017	Shrubby Cinquefoil Coastal Meadow Marsh Type	G2?	S1		27															
MAM5-2	CEGL005130	Perched Mineral Prairie Fen Type	G3G4	S1	1																
RBS1-2	CEON000202	Round-leaved Dogwood Limestone / Dolostone Shrubland Barren Type	G?	S3		1															
RBT3-1	CEGL005046	Pitch Pine Treed Granite Barren Type	G3G5	S1																	
SBO1-2	CEON000153	Hay Sedge Sand Barren Type	G?	S1																	
SDO1-1	CEON000126	Little Bluestem - Switchgrass - Beachgrass Dune Grassland Type	G?	S2					1	X											
SDO1-2	CEON000127	Little Bluestem - long-leaved Reed Grass - Great Lakes Wheat Grass Dune Grassland Type																			X
SDS1-3	CEGL005064	Juniper Dune Shrubland Type	G?	S2		X				1			X								X

S. ONT ELC CODE	ELCODE	COMMON NAME	GRANK	SRANK	BRANT	BRUCE	DUFFERIN	DURHAM	ELGIN	ESSEX	FRONTENAC	GREY	HALDIMAND-NORFOLK	HALIBURTON	HALTON	HAMILTON-WENTWORTH	HASTINGS	HURON	KENORA	KENT	LAMBTON
SDT1-1	CEON000131	Cottonwood Dune Savannah Type	G1G2	S1						2			X								X
SWT2-8	CEON000057	Silky Dogwood Mineral Thicket Swamp Type	G5	S3S4		24															
SWT3-13	CEGL005083	Poison Sumac Organic Thicket Swamp Type	G4?	S3	X					X			1								
SWT3-14	CEON000072	Huckleberry Organic Thicket Swamp Type	G2Q	S1																	
SWT3-4	CEON000065	Buttonbush Organic Thicket Swamp Type	G4	S3									1								
SWT3-7	CEON000067	Winterberry Organic Thicket Swamp Type	G3G4Q	S3S4													1				
TAO1-1	CEON000199	Dry Herbaceous Limestone / Dolostone Talus	G?	S2		12	X					3			1	4					
TAO1-2	CEON000200	Wet Herbaceous Limestone / Dolostone Talus	G?	S2		3	X								X	X					
TAS1-2	CEGL005067	Mountain Maple Open Limestone Talus Shrubland Type	G?	S3		2	X					3			4	X					
TAT1-2	CEON000138	White Birch Dry Treed Limestone Talus Type	G3G5	S3		4									3	1					
TAT1-3	CEGL005172	White Cedar Dry Treed Limestone Talus Type	G?	S3		6	X					20			13	X					
TAT1-4	CEON000139	Sugar Maple Moist Treed Limestone Talus Type	G3G5	S3		5						6			14	1					
TAT1-5	CEON000140	Basswood - White Ash - Butternut Moist Treed Limestone Talus Type	G3G5	S2		2									2						
TAT1-6	CEGL005190	Hemlock - Sugar Maple Moist Limestone Talus Type	G?	S2								3			7						X
TPO1-1	CEGL002210	Dry Tallgrass Prairie Type	G3	S1	2					X			4			X	9				X
TPO2-1	CEGL005096	Moist - Fresh Tallgrass Prairie Type	G2	S1					3	X										X	
TPS1-1	CEGL002492	Dry Black Oak Tallgrass Savannah Type	G3	S1	1																X
TPS1-2	CEGL005129	Dry Black Oak-Pine Tallgrass Savannah Type	G?	S1									X				1				X
TPS2-1	CEON000155	Moist - Fresh Pin Oak - Bur Oak Tallgrass Savannah Type	G1	S1																	
TPW1-1	CEGL005029	Dry Black Oak - White Oak Tallgrass Woodland Type	G?	S1	X											X	12				X
TPW1-2	CEON000230	Dry Bur Oak - Shagbark Hickory Tallgrass Woodland Type	G?	S1													4				
TPW2-1	CEON000156	Moist - Fresh Black Oak - White Oak Tallgrass Woodland Type	G2	S1						X											X
TPW2-2	CEON000158	Moist - Fresh Pin Oak Tallgrass Woodland Type	G1	S1						X										X	
	CEON000322	Black Spruce - Tamarack - Leatherleaf Patterned Fen Type																			

S. ONT ELC CODE	ELCODE	COMMON NAME	LANARK	LEEDS & GRENVILLE	LENNOX & ADDINGTON	MANITOULIN	MIDDLESEX	MUSKOKA	NIAGARA	NORTHUMBERLAND	OTTAWA-CARLETON	OXFORD	PARRY SOUND	PEEL	PERTH	PETERBOROUGH	PRESCOTT & RUSSELL	PRINCE EDWARD	RAINY RIVER	RENFREW	SIMCOE
ALO1-1	CEGL005192	Dry Lichen-Moss Open Alvar Pavement Type	2			5					2									X	
ALO1-2	CEGL005235	Dry Annual Open Alvar Pavement Type	2		2	2					2							X		X	
ALO1-3	CEON000218	Northern Dropseed - Little Bluestem - Scirpus-like Sedge Alvar Grassland Type	1		2	10					X							2		X	
ALO1-4	CEON000225	White Cedar - White Spruce - Philadelphia Panic Grass Treed Alvar Grassland Type	X		1	2					2							X		X	
ALO1-5	CEON000219	Tufted Hairgrass - Canada Bluegrass - Philadelphia Panic Grass Alvar Grassland Type			1	10												2			
ALS1-1	CEON000222	Common Juniper - Fragrant Sumac - Hairy Beardtongue Alvar Shrubland Type	2			6					2									1	
ALS1-2	CEON000221	Creeping Juniper - common Juniper - Shrubby Cinquefoil Alvar Shrubland Type				10															
ALS1-3	CEON000216	Shrub Conifer - Dwarf Lake Iris Alvar Shrubland Type				6															
ALT1-1	CEON000220	Chinquapin Oak - Canada Bluegrass - Nodding Onion Alvar Grassland Type																			
ALT1-2	CEGL005230	Shagbark Hickory - Prickly Ash Treed Alvar																			
ALT1-3	CEON000229	Jack Pine - White Cedar - Common Juniper Treed Alvar Shrubland Type	X			X					X									X	
ALT1-4	CEON000223	White Cedar - Jack Pine - Shrubby Cinquefoil Treed Alvar Pavement				X															
ALT1-5	CEON000226	Red Cedar - Early Buttercup Treed Alvar Grassland Type			X													2			
BBO1-1	CEGL005162	Sea Rocket Sand Beach Type																			X
BOS2-1	CEON000121	Leatherleaf Shrub Kettle Peatland Type					X			1		X									X
CLO1-1	CEON000133	Cliffbrake - Lichen Open Unshaded Limestone / Dolostone Cliff Face Type							9												
CLO1-2	CEON000134	Bulblet Fern - Herb Robert Open Shaded Limestone / Dolostone Cliff Face Type							22					6							X
CLO1-4	CEGL002048	Open Limestone / Dolostone Seepage Cliff Type							6					1							X
CLO1-5	CEON000136	Open Limestone / Dolostone Cliff Rim Type							X												X
CLS1-1	CEGL005066	Common Juniper Open Limestone / Dolostone Cliff Rim Shrubland Type																			
CLS1-2	CEGL005070	Round-leaved Dogwood Open Limestone / Dolostone Cliff Rim Shrubland Type							1												
CLT1-1	CEGL002451	White Cedar Treed Limestone Cliff Type							2					2							X
FET1-3	CEON000117	Gray Birch Treed Fen Type															2				
FOC4-2	CEON000103	White Cedar - Hemlock Coniferous Organic Swamp Type								5											
FOD1-3	CEGL005030	Dry Black Oak Deciduous Forest Type							7	6											
FOD1-4	CEON000162	Dry - Fresh Mixed Oak Deciduous Forest Type																			
FOD2-2	CEON000159	Dry Oak - Hickory Deciduous Forest Type																			
FOD2-3	CEON000164	Dry - Fresh Hickory Deciduous Forest Type																			
FOD4-3	CEGL005021	Dry - Fresh Hackberry Deciduous Forest Type																			
FOD6-2	CEON000178	Moist - Fresh Sugar Maple - Black Maple Deciduous Forest Type							17			1		2							
FOD7-4	CEON000181	Moist - Fresh Black Walnut Deciduous Forest Type							3												
MAM2-8	CEON000022	Prairie Slough Grass Mineral Meadow Marsh Type																			
MAM3-7	CEON000029	Prairie Slough Grass Organic Meadow Marsh Type																			
MAM4-1	CEON000016	Graminoid Coastal Meadow Marsh Type								2								3			3
MAM4-2	CEON000017	Shrubby Cinquefoil Coastal Meadow Marsh Type																			1
MAM5-2	CEGL005139	Perched Mineral Prairie Fen Type																			
RBS1-2	CEON000202	Round-leaved Dogwood Limestone / Dolostone Shrubland Barren Type																			
RBT3-1	CEGL005046	Pitch Pine Treed Granite Barren Type		11																	
SBO1-2	CEON000153	Hay Sedge Sand Barren Type								1											
SDO1-1	CEON000126	Little Bluestem - Switchgrass - Beachgrass Dune Grassland Type								X								X			
SDO1-2	CEON000127	Little Bluestem - long-leaved Reed Grass - Great Lakes Wheat Grass Dune Grassland Type																			
SDS1-3	CEGL005064	Juniper Dune Shrubland Type																			

S. ONT ELC CODE	ELCODE	COMMON NAME	LANARK	LEEDS & GRENVILLE	LENNOX & ADDINGTON	MANITOULIN	MIDDLESEX	MUSKOKA	NIAGARA	NORTHUMBERLAND	OTTAWA-CARLETON	OXFORD	PARRY SOUND	PEEL	PERTH	PETERBOROUGH	PRESCOTT & RUSSELL	PRINCE EDWARD	RAINY RIVER	RENFREW	SIMCOE
SDT1-1	CEON000131	Cottonwood Dune Savannah Type																			
SWT2-8	CEON000057	Silky Dogwood Mineral Thicket Swamp Type																			
SWT3-13	CEGL005033	Poison Sumac Organic Thicket Swamp Type																			
SWT3-14	CEON000072	Huckleberry Organic Thicket Swamp Type					1														
SWT3-4	CEON000065	Buttonbush Organic Thicket Swamp Type																			
SWT3-7	CEON000067	Winterberry Organic Thicket Swamp Type																			
TAO1-1	CEON000199	Dry Herbaceous Limestone / Dolostone Talus							7												X
TAO1-2	CEON000200	Wet Herbaceous Limestone / Dolostone Talus							2												X
TAS1-2	CEGL005067	Mountain Maple Open Limestone Talus Shrubland Type							2					3							X
TAT1-2	CEON000138	White Birch Dry Treed Limestone Talus Type							3												
TAT1-3	CEGL005172	White Cedar Dry Treed Limestone Talus Type							3												X
TAT1-4	CEON000139	Sugar Maple Moist Treed Limestone Talus Type							2												
TAT1-5	CEON000140	Basswood - White Ash - Butternut Moist Treed Limestone Talus Type												1							
TAT1-6	CEGL005190	Hemlock - Sugar Maple Moist Limestone Talus Type							8					1							
TPO1-1	CEGL002210	Dry Tallgrass Prairie Type					2			13											
TPO2-1	CEGL005096	Moist - Fresh Tallgrass Prairie Type																			
TPS1-1	CEGL002492	Dry Black Oak Tallgrass Savannah Type																			
TPS1-2	CEGL005129	Dry Black Oak-Pine Tallgrass Savannah Type								8											X
TPS2-1	CEON000155	Moist - Fresh Pin Oak - Bur Oak Tallgrass Savannah Type																			
TPW1-1	CEGL005029	Dry Black Oak - White Oak Tallgrass Woodland Type							X	13											
TPW1-2	CEON000230	Dry Bur Oak - Shagbark Hickory Tallgrass Woodland Type																1			
TPW2-1	CEON000156	Moist - Fresh Black Oak - White Oak Tallgrass Woodland Type																			
TPW2-2	CEON000158	Moist - Fresh Pin Oak Tallgrass Woodland Type																			
	CEON000322	Black Spruce - Tamarack - Leatherleaf Patterned Fen Type															3				

S. ONT ELC CODE	ELCODE	COMMON NAME	S.D.G	THUNDER BAY	TORONTO	VICTORIA	WATERLOO	WELLINGTON	YORK
ALO1-1	CEGL005192	Dry Lichen-Moss Open Alvar Pavement Type							
ALO1-2	CEGL005235	Dry Annual Open Alvar Pavement Type							
ALO1-3	CEON000218	Northern Dropseed - Little Bluestem - Scirpus-like Sedge Alvar Grassland Type				3			
ALO1-4	CEON000225	White Cedar - White Spruce - Philadelphia Panic Grass Treed Alvar Grassland Type				2			
ALO1-5	CEON000219	Tufted Hairgrass - Canada Bluegrass - Philadelphia Panic Grass Alvar Grassland Type				5			
ALS1-1	CEON000222	Common Juniper - Fragrant Sumac - Hairy Beardtongue Alvar Shrubland Type				6			
ALS1-2	CEON000221	Creeping Juniper - common Juniper - Shrubby Cinquefoil Alvar Shrubland Type							
ALS1-3	CEON000216	Shrub Conifer - Dwarf Lake Iris Alvar Shrubland Type							
ALT1-1	CEON000220	Chinquapin Oak - Canada Bluegrass - Nodding Onion Alvar Grassland Type							
ALT1-2	CEGL005230	Shagbark Hickory - Prickly Ash Treed Alvar							
ALT1-3	CEON000229	Jack Pine - White Cedar - Common Juniper Treed Alvar Shrubland Type				X			
ALT1-4	CEON000223	White Cedar - Jack Pine - Shrubby Cinquefoil Treed Alvar Pavement				1			
ALT1-5	CEON000226	Red Cedar - Early Buttercup Treed Alvar Grassland Type							
BBO1-1	CEGL005162	Sea Rocket Sand Beach Type							
BOS2-1	CEON000121	Leatherleaf Shrub Kettle Peatland Type					X	X	X
CLO1-1	CEON000133	Cliffbrake - Lichen Open Unshaded Limestone / Dolostone Cliff Face Type							
CLO1-2	CEON000134	Bulblet Fern - Herb Robert Open Shaded Limestone / Dolostone Cliff Face Type							
CLO1-4	CEGL002048	Open Limestone / Dolostone Seepage Cliff Type							
CLO1-5	CEON000136	Open Limestone / Dolostone Cliff Rim Type							
CLS1-1	CEGL005066	Common Juniper Open Limestone / Dolostone Cliff Rim Shrubland Type							
CLS1-2	CEGL005070	Round-leaved Dogwood Open Limestone / Dolostone Cliff Rim Shrubland Type							
CLT1-1	CEGL002451	White Cedar Treed Limestone Cliff Type							
FET1-3	CEON000117	Gray Birch Treed Fen Type							
FOC4-2	CEON000103	White Cedar - Hemlock Coniferous Organic Swamp Type							
FOD1-3	CEGL005030	Dry Black Oak Deciduous Forest Type							
FOD1-4	CEON000162	Dry - Fresh Mixed Oak Deciduous Forest Type							
FOD2-2	CEON000159	Dry Oak - Hickory Deciduous Forest Type							
FOD2-3	CEON000164	Dry - Fresh Hickory Deciduous Forest Type							
FOD4-3	CEGL005021	Dry - Fresh Hackberry Deciduous Forest Type							
FOD6-2	CEON000178	Moist - Fresh Sugar Maple - Black Maple Deciduous Forest Type							
FOD7-4	CEON000181	Moist - Fresh Black Walnut Deciduous Forest Type							
MAM2-8	CEON000022	Prairie Slough Grass Mineral Meadow Marsh Type							
MAM3-7	CEON000029	Prairie Slough Grass Organic Meadow Marsh Type							
MAM4-1	CEON000016	Graminoid Coastal Meadow Marsh Type			2				
MAM4-2	CEON000017	Shrubby Cinquefoil Coastal Meadow Marsh Type							
MAM5-2	CEGL005139	Perched Mineral Prairie Fen Type							
RBS1-2	CEON000202	Round-leaved Dogwood Limestone / Dolostone Shrubland Barren Type							
RBT3-1	CEGL005046	Pitch Pine Treed Granite Barren Type							
SBO1-2	CEON000153	Hay Sedge Sand Barren Type							
SDO1-1	CEON000126	Little Bluestem - Switchgrass - Beachgrass Dune Grassland Type							
SDO1-2	CEON000127	Little Bluestem - long-leaved Reed Grass - Great Lakes Wheat Grass Dune Grassland Type							
SDS1-3	CEGL005064	Juniper Dune Shrubland Type							

S. ONT ELC CODE	ELCODE	COMMON NAME	S.D.G	THUNDER BAY	TORONTO	VICTORIA	WATERLOO	WELLINGTON	YORK
SDT1-1	CEON000131	Cottonwood Dune Savannah Type							
SWT2-8	CEON000057	Silky Dogwood Mineral Thicket Swamp Type							
SWT3-13	CEGL005083	Poison Sumac Organic Thicket Swamp Type					X		
SWT3-14	CEON000072	Huckleberry Organic Thicket Swamp Type							
SWT3-4	CEON000065	Buttonbush Organic Thicket Swamp Type							
SWT3-7	CEON000067	Winterberry Organic Thicket Swamp Type							
TAO1-1	CEON000199	Dry Herbaceous Limestone / Dolostone Talus							
TAO1-2	CEON000200	Wet Herbaceous Limestone / Dolostone Talus							
TAS1-2	CEGL005067	Mountain Maple Open Limestone Talus Shrubland Type							
TAT1-2	CEON000138	White Birch Dry Treed Limestone Talus Type							
TAT1-3	CEGL005172	White Cedar Dry Treed Limestone Talus Type							
TAT1-4	CEON000139	Sugar Maple Moist Treed Limestone Talus Type							
TAT1-5	CEON000140	Basswood - White Ash - Butternut Moist Treed Limestone Talus Type							
TAT1-6	CEGL005190	Hemlock - Sugar Maple Moist Limestone Talus Type							
TPO1-1	CEGL002210	Dry Tallgrass Prairie Type			X		3		1
TPO2-1	CEGL005096	Moist - Fresh Tallgrass Prairie Type							
TPS1-1	CEGL002492	Dry Black Oak Tallgrass Savannah Type			X				
TPS1-2	CEGL005129	Dry Black Oak-Pine Tallgrass Savannah Type			X				
TPS2-1	CEON000155	Moist - Fresh Pin Oak - Bur Oak Tallgrass Savannah Type							
TPW1-1	CEGL005029	Dry Black Oak - White Oak Tallgrass Woodland Type			5		1		
TPW1-2	CEON000230	Dry Bur Oak - Shagbark Hickory Tallgrass Woodland Type							
TPW2-1	CEON000156	Moist - Fresh Black Oak - White Oak Tallgrass Woodland Type							
TPW2-2	CEON000158	Moist - Fresh Pin Oak Tallgrass Woodland Type							
	CEON000322	Black Spruce - Tamarack - Leatherleaf Patterned Fen Type							

APPENDIX N

Lists of Vascular Plant Indicators of Alvar, Tall Grass Prairie, Savannah and Carolinian Forests Habitats in Southern Ontario

The communities listed in this appendix are considered rare in Ontario. The tables in this appendix list those plants that are considered to be true indicators of these rare habitat types and can be used to identify the existence of the community, or in some cases, remnants of these communities.

Table N-1 List of vascular plant indicative of Alvar habitats in southern Ontario

Species – Scientific Name	**Common Name**	**Site 6**	**Site 7**	**Notes**
Allium cernuum	Nodding Wild Onion		X	
Allium schoenoprasum	Wild Chives	X		
Astragalus neglectus	Cooper's Milk-vetch	X		
Blephilia ciliata	Downy Wood Mint		X	
Bouteloua curtipendula	Side Oats Grama	X		
Carex crawei	Crawe's Sedge	X	X	
Carex juniperorum	Juniper Sedge	X		
Carex richardsonii	Richardson's Sedge	X		
Carex seirpoidea	Bulrush Sedge	X		
Cirsium hillii	Hill's Thistle	X		
Coreopsis lanceolata	Coreopsis	X		
Deschampsia caespitose	Tufted Hair Grass	X		
Eleocharis compressa	Flattened Spike-rush	X	X	
Euphorbia commutata	Tinted Spurge	X		
Geranium carolinianum	Carolina Cranesbill	X	X	
Geum triflorum	Prairie Smoke	X		
Hymenoxys herbacea	Lakeside Daisy	X	X	
Myosurus minimus	Mousetail	X		
Myosotis verna	Vernal Forget-me-not	X	X	
Panicum flexile	Panic-grass	X	X	
Panicum philadelphicum	Panic-grass	X	X	
Piperia unalascensis	Alaskan Orchid	X		
Poa alpina	Alpine Bluegrass	X		
Polygana senega	Seneca-snakeroot	X	X	
Ranunculus fascicularis	Early Buttercup	X	X	
Scutellaria parvula	Small Skullcap	X	X	
Solidago houghtonii	Houghton's Goldenrod	X		
Solidago ptarmicoides	Upland Goldenrod	X		
Sporabolus heterolepis	Northern Dropseed	X		
Trichostema brachiatum	False Pennyroyal	X	X	
Valerianella umbilicata	Corn-salad		X	
Verena simplex	Simple Vervain	X	X	

Table N-2. List of vascular plant indicative of Tall Grass Prairie and Savannah habitats in southern Ontario

Species – Scientific Name	**Common Name**	**Site 6**	**Site 7**	**Notes**
Agalinis gattingeri	Gattinger's Agalinis		X	
Agalinis skinneriana	Skinner's Agalinis		X	
Aletris farinosa	Colicroot		X	
Aristida purpurascens	Arrow-feather Three-awn		X	
Ascelpias hirtella	Prairie Milkweed		X	
Ascelpias verticillata	Whorled Milkweed		X	
Aster prealtus var. prealtus	Willow Aster		X	
Baptisia tinctoria	Wild Indigo		X	
Bouteloua curtipendula var. curtipendula	Side-oats Gramma	X	X	
Buchnera americana	Blue-hearts		X	
Carex bicknellii var. bicknellii	Bicknell's Sedge		X	
Carex inops ssp. heliophila	Sun Sedge		X	
Carex meadii	Mead's Sedge		X	
Carex mesochorea	Midland Sedge		X	
Carex suberecta	Prairie Straw Sedge		X	
Celtis tenuifolia	Dwarf Hackberry	X	X	
Coreopsis tripteris	Tall Tickseed		X	
Cuscuta coryli	Hazel Dodder		X	
Dalea purpurea	Purple Prairie Clover			Extirpated
Desmodium illinoense	Illinois Tick-trefoil	X	X	Extirpated
Desmodium marilandicum	Smooth Small-leaved Tick-trefoil	X	X	Extirpated
Desmodium sessilifolium	Sessile-leaved Tick-trefoil		X	
Fimbristylis puberula var. puberula	Hairy Fimbristylis		X	
Gentiana alba	White Prairie Gentian	X	X	
Hypericum gentianoides	Orange-grass		X	
Juncus biflorus	Two-flowered Rush		X	
Juncus brachycarpus	Short-fruited Rush		X	
Krigia biflora	Orange dwarf			
Lechea intermedia	Dandelion		X	
Lechea pulchella	Leggett's Pinweed		X	
Lespedeza virginica	Slender Bush Clover		X	
Liatris aspera			X	
Liastris spicata	Dense Blazing Star		X	
Panicum leibergii	Leiber's Panic Grass		X	
Panicum praecocius	Hairy Panic Grass	X	X	
Panicum rigidulum var. rigidulum	Ridged Panic Grass	X	X	
Polygala cruciata	Cross-leaved Milkwort		X	
Polygala incarnata	Pink Milkwort		X	
Pycnanthemum incanum var. incanum	Hoary Mountain Mint		X	
Pycnanthemum pilosum	Whorled Mountain Mint		X	
Querus prinoides	Dwarf Chinquapin Oak		X	
Scleria pauciflora	Papilose Nut-rush		X	
Scleria triglomerata	Tall Nut-rush		X	
Silphium terebinthinaccum	Prairie Dock		X	
Solidago speciosa var. rigidiuscula	Showy Goldenrod		X	
Sphenopholis obtusata	Early Bunch Grass		X	
Spiranthes ovalis var. erostellata	Small-flowered Ladie's Tresses		X	
Tradescantia ohiensis	Ohio Spiderwort		X	
Viola pedata	Bird's-foot Violet		X	

Table N-3. List of species indicative of Carolinian forest habitats

The following species are largely restricted to forests, woodlands and forest edges of the Carolinian Forest Region of Ontario (Hill's Site Region 7E). Carolinian species found only in more open habitats, such as alvars and prairies, are listed in Tables N-1 and N-2. Many of the species listed here are rare in Ontario and so are also listed, together with additional detail on habitat and distribution, in Appendix G. Species which are known to occur at fewer than five localities in Ontario (i.e. S-1) have generally not been included in this table. Several of the species listed are quite widespread or common in portions of the adjacent Site Region 6E but have been included due to their abundance in forests of the Carolinian region of the province.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trees				
Acer nigrum	Black Maple	X	X	
Carya laciniosa	Big Shellbark Hickory		X	
Carya ovalis	Sweet Pignut Hickory		X	(C. glabra)
Carya ovata	Shagbark Hickory	X	X	
Castanea dentata	American Chestnut		X	Threatened in Canada
Celtis occidentalis	Hackberry	X	X	
Cercis canadensis	Redbud		X	Mostly planted in Ontario
Crategus spp.	Hawthorn		X	Several species, most are rare
Fraxinus quadrangulata	Blue Ash		X	Floodplains, threatened in Canada
Gleditsia triacanthos	Honey Locust		X	Widely planted elsewhere
Gymnocladus dioicus	Kentucky Coffee Tree		X	Threatened in Canada
Juglans nigra	Black Walnut	X	X	Most occurrences outside 7E are planted
Liriodendron tulipifera	Tulip Tree		X	Planted beyond natural range
Magnolia acuminata	Cucumber Tree		X	Endangered (in the wild) in Canada, often planted
Morus rubra	Red Mulberry		X	Endangered in Canada, hybridizes with M. alba
Nyssa sylvatica	Black Gum		X	
Platanus occidentalis	Plane Tree, Sycamore	X	X	Frequently planted beyond natural range
Ptelea trifoliata	Hoptree		X	Thickets, open woods, vulnerable in Canada
Quercus bicolor	Swamp White Oak	X	X	
Quercus muhlenbergii	Chinquapin Oak	X	X	
Quercus palustris	Pin Oak		X	Wet forests
Quercus shumardii	Shumard Oak		X	Vulnerable in Canada
Quercus velutina	Black Oak	X	X	Woodlands and savannahs
Salix nigra	Black Willow	X	X	
Shrubs and Woody Vines				
Asimina triloba	Pawpaw		X	Edges
Campsis radicans	Trumpet Creeper		X	Edges
Celtis tenuifolia	Dwarf Hackberry	X	X	Woodlands, vulnerable in Canada
Cornus drummondii	Rough-leaved Dogwood		X	Edges
Cornus florida	Flowering Dogwood		X	Now very rare
Corylus americana	American Hazel	X	X	Edge species
Crategus crus-galli	Cockspur Hawthorn		X	Edges, thickets
Euonymus atropurpurea	Burning Bush		X	
Euonymus obovatus	Running Strawberry Bush	X	X	
Hamamelis virginiana	Witch-hazel	X	X	
Hypericum prolificum	Shrubby St. John's-wort		X	Open sandy woods, rare
Lindera benzoin	Spicebush	X	X	
Malus coronaria	Wild Crabapple		X	Edges, thickets
Prunus americana	Wild plum		X	Thickets, edges, planted north of natural range
Quercus prinoides	Dwarf Chinquapin Oak		X	Woodlands, also open dunes
Rhus vernix	Poison Sumach	X	X	Swamps
Rosa carolina	Pasture Rose		X	Edges, thickets
Rosa setigera	Prairie Rose	X	X	Open woods, edges, thickets; vulnerable in Canada
Sassafras albidum	Sassafras		X	
Smilax rotundifolia	Round-leaved Greenbrier		X	Threatened in Canada
Staphylea trifoliata	Bladdernut	X	X	
Vaccinium corymbosum	High-bush Blueberry	X	X	Low, acid woods
Vaccinium pallidum	Dryland Blueberry	X	X	Dry acid woods

Viburnum recognitum	Southern Arrowwood	X	X	Swampy woods
Vitis aestivalis	Summer Grape		X	Thickets, open woods
Vitis labrusca	Fox Grape		X	Woods, thickets, rare
Non-woody Vascular Plants				
Agrimonia parviflora	Swamp Agrimony		X	Damp woods but mostly open areas
Aletris farinosa	Colic Root		X	Woods, thickets and openings, threatened in Canada
Allium cernuum	Nodding Onion		X	Dry woods, prairies
Anemonella thalictroides	Rue-anemone	X	X	
Aplectrum hyemale	Putty-root	X	X	
Arisaema dracontium	Green Dragon		X	Floodplains, vulnerable in Canada
Asclepias exaltata	Poke Milkweed		X	
Asclepias verticillata	Whorled Milkweed	X	X	Open sandy woods
Aster prenanthoides	Crooked-stem Aster		X	Vulnerable in Canada
Aster schreberi	Schreber's Aster		X	
Aster shortii	Short's Aster		X	
Aureolaria pedicularia	Fern-leaved False Foxglove		X	Oak woodlands
Baptisia tinctoria	Yellow Wild Indigo		X	Open woods and prairies
Camassia scilloides	Wild Hyacinth		X	Meadows and open woods, vulnerable in Canada
Campanula americana	Tall Bellflower		X	Moist woods and thickets
Carex careyana	Carey's Wood Sedge		X	
Carex davisii	Awned Graceful Sedge		X	Low woods
Carex gracilescens	Slender Wood Sedge		X	
Carex grayii	Gray's Sedge	X	X	Low woods
Carex hirsutella	Hairy Green Sedge		X	
Carex jamesii	Grass Sedge		X	
Carex muskingumensis	Swamp Oval Sedge		X	Wet hardwood forests
Carex seorsa	sedge		X	Wet woods
Carex squarrosa	Narrow-leaved Cattail Sedge		X	Floodplain hardwoods forests
Carex swanii	Downy Green Sedge		X	Edges and forest openings
Carex virescens	Slender Green Sedge		X	Sandy, open woods
Chaerophyllum procumbens	Spreading Chervil		X	Low woods, edges
Chenopodium standleyanum	Woodland Goosefoot		X	
Cimicifuga racemosa	Black Cohosh		X	
Collinsonia canadensis	Horse-balm		X	
Conioselinum chinense	Hemlock-parsley		X	Swampy woods
Corallorhiza odontorhiza	Autumn Coral-root		X	Pine and pine-oak woods
Corydalis flavula	Yellow Corydalis		X	Sand or rocky woods
Cystopteris protrusa	Lowland Brittle Fern		X	
Desmodium canescens	Hairy Tick-trefoil		X	
Desmodium cuspidatum	Bracted Tick-trefoil	X	X	
Desmodium paniculatum	Tick-trefoil		X	
Desmodium rotundifolium	Round-leaved Tick-trefoil	X	X	
Discorea villosa	Wild Yam		X	
Disporum lanuginosum	Yellow Mandarin		X	
Erigenia bulbosa	Harbinger-of-spring		X	Low woods
Erythronium albidum	White Trout-lily	X	X	
Eupatorium purpureum	Purple-jointed Joe Pye Weed		X	Rocky woods
Floerkia proserpinacoides	False Mermaid	X	X	Wet woods
Frasera caroliniensis	American Columbo		X	Vulnerable in Canada
Galium pilosum	Hairy Bedstraw		X	
Geum vernum	Spring Avens		X	Low woods and floodplains
Geranium maculatum	Spotted Geranium	X	X	
Heuchera americana	Alum-root		X	
Heuchera richardsonii	Richardson's Heuchera		X	Woodlands and open sites
Hibiscus moscheutos	Swamp Rose Mallow	X	X	Swamps and marshes, vulnerable in Canada
Hieraceum paniculatum	Panicled Hawkweed	X	X	
Hybanthus concolor	Green Violet	X	X	
Hydrastis canadensis	Golden Seal	X	X	Threatened in Canada, occasionally planted
Hydrophyllum appendiculatum	Appendaged Waterleaf		X	
Isopyrum biternatum	False Rue-anemone		X	Vulnerable in Canada
Jeffersonia diphylla	Twinleaf	X	X	
Kriga biflora	Two-flowered Cynthia		X	Woodlands and open areas
Lactuca floridana	Woodland Blue Lettuce		X	
Leersia virginica	Virginia Cutgrass	X	X	

Lespedeza hirta	Hairy Bush-clover	X	X	Dry woods and openings
Lespedeza intermedia	Intermediate Bush-clover	X	X	Dry woods and openings
Linum virginianum	Slender Yellow Flax		X	Dry open woods and edges
Liparis liliifolia	Purple Twayblade	X	X	Sandy woods and thickets; endangered in Canada
Lithospermum latifolium	Broad-leaved Puccoon		X	Low woods and edges
Lupinus perennis	Wild Lupine		X	Open woods and prairies, also planted
Lycopus rubellus	Stalked Water Horehound		X	Wet forests and thickets
Menispermum canadense	Moonseed	X	X	
Mertensia virginica	Bluebells		X	Wet woods and thickets
Mimulus alatus	Winged Monkey Flower		X	
Oxytropis rigidor	Stiff Cowbane		X	Swamps and low woods
Panicum clandestinum	Broadleaf Panic-grass		X	
Panicum dichotomum	Forked Panic-grass	X	X	
Peltandra virginica	Arrow Arum	X	X	Swamps, also marshes
Phlox divaricata	Blue Phlox	X	X	
Phytolaca americana	Pokeweed	X	X	Open forests and edges
Polygonatum biflorum	Hairy Solomon's-seal		X	
Polygonum virginianum	Virginia Knotweed		X	Swamps and wet woods
Polymnia canadensis	Small-flowered Leafcup	X	X	
Sanicula canadensis	Canadian Snakeroot		X	
Smilax ecirrata	Upright Carrion-flower		X	
Smilax illinoensis	Illinois Carrion-flower		X	
Smilax lasioneura	Hairy-nerved Carrion-flower		X	
Solidago patula	Rough-leaved Goldenrod	X	X	
Taenidia integerrima	Yellow Pimpernel	X	X	Sandy or rocky woodlands
Thalictrum revolutum	Waxy Meadow-rue		X	Wet woods and edges
Thaspium trifoliatum	Meadow Parsnip		X	
Tradescantia ohiensis	Ohio Spiderwort		X	Moist open woodlands
Uvularia perfoliata	Perfoliate Bellwort		X	
Uvularia sessilifolia	Sessile-leaved Bellwort	X	X	
Verbesina alternifolia	Wingstem		X	Low woods and shore thickets
Veronia gigantica	Ironweed		X	Floodplain woods and open areas
Veronicastrum virginicum	Culver's-root		X	Open woods and prairies
Vicia caroliniana	Wood Vetch		X	Dry woods and prairies
Viola palmata	Palmate Violet		X	(Incl. var. dilatata)
Viola striata	Cream Violet		X	
Birds				
Caprimulgus carolinensis	Chuck-Will's-Widow		X	
Epidonax virescens	Acadian Flycatcher		X	Endangered in Canada
Icteria virens	Yellow-breasted Chat		X	Vulnerable in Canada
Icterus spurius	Orchard Oriole	X	X	Range is expanding northward
Oporornis formosus	Kentucky Warbler		X	
Parus bicolor	Tufted Titmouse	X	X	
Protonotaria citrea	Prothonotary Warbler		X	Endangered in Canada
Seiurus motacilla	Louisiana Waterthrush	X	X	Vulnerable in Canada
Thryothorus ludovicianus	Carolina Wren		X	
Vireo griseus	White-eyed Vireo	X	X	
Wilsonia citrina	Hooded Warbler		X	Vulnerable in Canada
Mammals				
Didelphis virginiana	Virginia Opossum	X	X	Sporadic more northerly occurrences
Glaucomys volans	Southern Flying Squirrel	X	X	Vulnerable in Canada, also in Site Region 5E
Pitymys pinetorum	Woodland Vole		X	Vulnerable in Canada (also known as Pine Vole)
Scalopus aquaticus	Eastern Mole		X	Vulnerable in Canada
Taxidea taxus	Badger	?	X	Vulnerable in Ontario, also in Site Region 5S

Appendix O
Finding and Identifying Hawk Nests

The underlying assumption is that undertaking this task is worthwhile because by finding and then trying to protect the breeding habitat of wildife such as hawks that require relatively large areas to survive, other wildlife that depend on the same general habitat (e.g., area-sensitive birds, mammals, and herptiles) can also benefit from such protection efforts.

The following guidelines are intended to help anyone trying to find and identify hawk nests and nesting habitat.

- Familiarize yourself with the birds and their nesting habitat requirements by reading about their natural history and biology and by consulting bird guides. Excellent sources include:
- Peck, G.K. and R.D. James.1983. *Breeding birds of Ontario. Nidiology and distribution. Volume 1: Nonpasserines*. Royal Ontario Life Sciences Miscellaneous Publication.
- Headstrom, R. 1961. *Birds' nests: a field guide*. Ives Washburn Inc.
- Szuba, K. and B. Naylor. 1998. *Forest Raptors and their nests in central Ontario. A guide to stick nests and their users.* Southcentral Section Field Guide FG-03, OMNR, North Bay. 75 p.
- Hawks will sometimes build or repair more than one nest within their nesting territory, but will only use one of them in any given year. This is particularly true for Red-shouldered Hawks and Northern Goshawks. Such nests are usually with 200m of each other.
- Signs of active nests include: down feathers stuck to the nest twigs and sticks, molted feathers near or under the nest tree, freshly broken ends on twigs used to build the nest. Northern Goshawks, Red-tailed Hawks, and Red-shouldered Hawks decorate their active nests with vegetation, often sprigs of conifer foliage, especially hemlock. Little decoration is usually seen on Cooper's, Sharp-shinned, and Broad-winged hawk nests. Active nests may also show some whitewash on the foliage of the nest tree and nearby trees and shrubs. Accumulations of feathers; regurgitated pellets of bits of bone, fur and/or feathers; as well as prey remains may also be found near the nest.
- Frequently the tail of the hawk (usually one of the accipiters) projects over the nest edge and is all that is visible to the observer on the ground.
- Use tape-recorded calls sparingly and watch for silent hawks (usually accipiters). Red-shouldered Hawks will call almost incessantly as they approach a tape-recorded call. Try to follow or retrace the flight path of hawks if they come to the tape.
- In March and April, investigate any calls just before dawn, that sound like pileated woodpeckers. They may be a pair of courting accipiters.
- Investigate what crows are mobbing (strong, incessant "cawing" by numerous birds). It could be an owl or one of these hawks.

If nests are found that appear active but no hawk is present, suspect a Cooper's Hawk nest. Sit hidden and quietly and use the back of your hand or predator call to produce a squeaking sound. These hawks may respond by flying into view long enough for an identification to be made.

Nests[1]

Sharp-shinned Hawk nests are usually well-hidden high in the foliage of conifer trees, especially spruce, in young to medium age forests. Dense groves of spruce are the preferred habitat.

Cooper's Hawk prefer to nest in deciduous trees (mainly beech and maple), but will also nest in the lower crown of white and red pines and hemlock. They often build their nests in pine plantations that are 30 years and older which are adjacent to mature deciduous forest. They may resemble crow nests, but will not have grass in the nest as do crow nests. These hawks are shy and will usually slip off the nest unnoticed.

Northern Goshawks are most commonly found in large, dense stands of mature or old growth forests, and will also use older pine plantations. They nest in both deciduous and coniferous trees. In conifers, the nest is close to the trunk and made of longer, thicker sticks than a Cooper's Hawk nest. Most nests are in conifers (red, white or jack pine), poplar, and yellow birch. Nests are often close to a clearing that provides a natural flight path nearby (an old creek bed, woodland road, break in the canopy). This species is very aggressive and likely to attack humans that are in the vicinity of the nest.

Broad-winged Hawk nests are usually found in dense forest and appear loose, and poorly built. They prefer to nest in yellow and white birch in denser, younger forests. They rarely nest in beech trees, and occasionally nest in pine plantations. They may decorate their nests with sprigs of green deciduous leaves.

Red-shouldered Hawks primarily in beech trees, followed by maple trees. Nest trees are usually large and tall. Their preferred nesting habitat appears to be mature, closed-canopy stands of maple-beech, with few saplings in the understory. The canopy often looks like an umbrella over the nest. This hawk shows the strongest preference for nesting near (equal or less than 250 m) water, especially small woodland ponds and creeks. This hawk now appears to nest mainly in large forest tracts of 200 ha or more, especially in areas where there are many Red-tailed Hawks. This hawk shows strong site fidelity (20 years or more) and is strongly territorial and very vocal during the breeding season.

Red-tailed Hawks build large nests high in a variety of trees and often reuse the same nest. They also decorate their nests, usually with fresh conifer foliage. Nests of this hawk are usually found near forest edges; in small, isolated woodlots; and in fence rows. They may also nest on hydro towers. They readily respond to recorded calls of Red-shouldered Hawks.

Merlins prefer to nest in old crow nests built near the top of spruce trees. They often nest near lake shores. They are very protective of the nest and will fly 500 m or more to harrass other birds.

---

[1] Hawk nests are not made of leaves - these are squirrel dreys

APPENDIX P

Endangered, Threatened and Vulnerable Species in Ontario

In Ontario, species of flora and fauna may be protected by regulation under *Ontario's Endangered Species Act* or by regulation under the new Fish and Wildlife Conservation Act. This appendix is comprised of two parts.

The first part (K-1) lists those species of flora and fauna that are protected by regulation under the *Endangered Species Act*. This Regulation was last revised in 1994. For those with Internet access, *Regulations of Ontario* can be searched by subject heading at the following location – http: //209.195.107.57/en/index.html

Copies of this or any other piece of Ontario legislation or regulation can be purchased by calling 1-800-668-9938 or by writing: Publications Ontario, 50 Grosvenor Street, Toronto, Ontario M7A 1N8.

The second part of this appendix (K-2) lists those Ontario species of flora and fauna that have been designated as endangered, threatened, vulnerable, indeterminate or extirpated by the Ontario Ministry of Natural Resources (OMNR) and/or the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Designations made by OMNR as of January 1995 are based on recommendations of a Ministry technical committee called the Committee of the Status of Species at Risk in Ontario (COSSARO). The work of COSSARO is integrated with the work of COSEWIC. Designations assigned by OMNR?COSSARO apply at the provincial level, while those of COSEWIC apply at the national level. There may be some differences between provincial and national designations.

It should be noted that COSEWIC designation is revised annually. COSEWIC designations in this appendix were last revised September 1999 (see http://www.cosewic.gc.ca/COSEWIC/).

OMNR/COSSARO designations are revised on an "as needed" basis. Designations in this appendix were last revised September 1998 (see http://www.mnr.gov.on.ca/MNR/fwmenu.html or http://www.mnr.gov.on.ca/MNR/nhic/nhic.html).

Up-to-date COSEWIC and OMNR/COSARO lists are also available for review at local OMNR offices and also include species of fish as well as those species of flora and fauna that are designated as extinct.

OMNR/COSSARO Status Definitions

EXTINCT: Any species formally native to Ontario that no longer exists.

EXTIRPATED: Any native species no longer existing in the wild in Ontario, but existing elsewhere in the wild.

ENDANGERED: any native species that, on the basis of the best available scientific evidence, is at risk of extinction or extirpation throughout all or a significant portion of its Ontario range if the limiting factors are not reversed.

THREATENED: Any native species that, on the basis of the best available scientific evidence, is at risk of becoming endangered throughout all or a significant portion of its Ontario range is limiting factors are not reversed.

VULNERABLE: any native species that, on the basis of the best available scientific evidence, is a species of special concern in Ontario, but is not a threatened or endangered species.

INDETERMINATE: Any species for which there is insufficient scientific information on which to base a status recommendation.

COSEWIC Status Definitions

EXTINCT: A species that no longer exists.

EXTIRPATED: A species no longer existing in the wild in Canada, but occurring elsewhere.

ENDANGERED: A species facing imminent extirpation or extinction.

THREATENED: A species likely to become endangered if limiting factors are not reversed.

VULNERABLE: A species of special concern because characteristics that make it particularly sensitive to human activities or natural events.

INDETERMINATE: A species for which there is insufficient information to support a status designation.
NOT AT RISK: A species that has been evaluated and found to be not at risk.

R-1: Endangered Species Declared in Regulation under the Endangered Species Art, R.S.O. 1990, c.E. 15

Common Name	Scientific Name
Vascular Plants	
Small White Lady's-Slipper Orchid [1]	*Cypripedium candidum*
Small Whorled Pogonia [2]	*Isotria medeoloides*
Large Whorled Pogonia [3]	*Iostria verticillata*
Cucumber Tree [4,5]	*Magnolia acuminata*
Wood Poppy [6]	*Stylophorum diphyllum*
Prickly Pear Cactus [7,8]	*Opuntia humifusa*
Hoary Mountian-mint [9]	*Pycnanthemum incanum*
Heart-leaved Plantain [10]	*Plantago cordata*
Amphibians	
Blanchard's Cricket Frog [11]	*Acris crepitans blanchardi*
Reptiles [12]	
Lake Erie Water Snake [13]	*Nerodia sipedon insularum*
Blue Racer [14]	*Coluber constrictor flaviventris*
Timber Rattlesnake	*Crotalus horridus*
Birds	
White Pelican [15]	*Pelecanus erythrorhynchos*
Bald Eagle [16]	*Haliaeetus leucocephalus alascanus*
Golden Eagle [17]	*Aquila chrysaetos*
Peregrine Falcon [18]	*Falco peregrinus*
Piping Plover [19]	*Charadrius melodus*
Eskimo Curlew	*Numenius borealis*
Loggerhead Shrike [20]	*Lanius ludovicianus*
Kirtland's Warbler [21]	*Dendroica kirtlandii*
Henslow's Sparrow [22]	*Ammodramus henslowii*
Mammals	
Mountain Lion (Eastern Cougar) [23]	*Felis concolor couguar*
Insects	
Frosted Elfin [24]	*Incisalia irus*
Karner Blue Butterfly [25]	*Lycaeides melissa samuelis*

---

[1] Designated as nationally endangered by COSEWIC in 1999; declared in Regulation under the *Endangered Species Act, R.S.O. 1990, c. E. 15* in 1978.

[2] Designated as nationally endangered by COSEWIC in 1982; designation reconfirmed in 1998.

[3] Designated as nationally endangered by COSEWIC in 1986; designation reconfirmed 1998.

[4] Designated as nationally endangered by COSEWIC in 1984.

[5] The regulation protects Cucumber Tree in specified locations only.

[6] Designated as nationally endangered by COSEWIC in 1993.

[7] Designated as nationally endangered by COSEWIC in 1985; designation reconfirmed in 1998.

[8] The Regulation protects Prickly Pear Cactus in specified locations only.

[9] Designated as nationally endangered by COSEWIC in 1986; designation reconfirmed in 1998.

[10] Designated as nationally endangered by COSEWIC in 1985; designation reconfirmed in 1998.

[11] Blanchard's Cricket Frog is also protected in Regulation under the *Fish and Wildlife Conservation Act*. Designated as nationally endangered by COSEWIC in 1990.

[12] The three snakes on this list are also protected in Regulation under the *Fish and Wildlife Conservation Act*.

[13] Designated as nationally endangered by COSEWIC in 1991.

[14] Desingated as nationally endangered by COSEWIC in 1991.

[15] Designated as nationally threatened by COSEWIC in 1978; delisted in 1987.

[16] COSEWIC reviewed the national status of the Bald Eagle in 1984 and did not assign a status designation.

[17] Designated as "not at risk" nationally by COSEWIC in 1996.

[18] Subspecies *Falco peregrinus anatum* designated as nationally endangered in 1978; downlisted to nationally threatened by COSEWIC in 1999; COSEWIC downlisted *F. p. tundrius* from nationally threatened to nationally vulnerable in 1992; all subspecies of *F. peregrinus* covered in Regulation under the *Endangered Species Act, R.S.O. 1990, c. E. 15* in 1973.

[19] Designated as nationally endangered by COSEWIC in 1985.

[20] Eastern population of Loggerhead Shrike designated as nationally endangered by COSEWIC in 1991, western population designated as nationally threatened in 1991. In Canada, the eastern population is restricted to Ontario, Quebec and Manitoba.

[21] Designated as nationally endangered by COSEWIC in 1979; status reconfirmed by COSEWIC in 1999.

[22] Designated as nationally endangered by COSEWIC in 1993.

[23] Designated as nationally endangered by COSEWIC in 1978; designated as nationally indeterminate by COSEWIC in 1998.

[24] Designated as nationally extirpated by COSEWIC in 1999; declared in Regulation under the *Endangered Species Act, R.S.O. 1990, c. E. 15* in 1990.

[25] Designated as nationally extirpated by COSEWIC in 1997

R-2: Endangered, Threatened, Vulnerable Species of Flora and Fauna in Ontario

Endangered *(but not in Regulation under Endangered Species Act)*

Common and Scientific Names	Designating Authority	Year Designated
Vascular Plants		
Engelmann's Quillwort		
Isoetes engelmannii	COSEWIC	1992
Juniper Sedge		
Carex juniperorum	COSEWIC	1999
Drooping Trillium		
Trillium flexipes	COSEWIC	1996
Small White Lady's-slipper Orchid[1]		
Cypripedium candidum	COSEWIC	1999
Purple Twayblade[2]		
Liparis lilifolia	COSEWIC	1999
Nodding Pogonia[3]		
Triphora trianthophora	COSEWIC	1999
American Ginseng[4]		
Panax quinquefolium	COSEWIC	1999
Pitcher's Thistle[5]		
Cirsium pitcheri	COSEWIC	1999
Showy Goldenrod		
Solidago speciosa	COSEWIC	1999
White Prairie Gentian		
Gentiana alba	COSEWIC	1991
Slender Bush Clover		
Lespedeza virginica	COSEWIC	1986; reconfirmed status in 1999
Scarlet Ammania		
Ammania robusta	COSEWIC	1999
Toothcup		
Rotala ramosior	COSEWIC	1999
Cucumber Tree[6]		
Magnolia acuminata	COSEWIC	1999
Red Mulberry[7]		
Morus rubra	COSEWIC	1999
Pink Milkwort		
Polygala incarnata	COSEWIC	1984; reconfirmed status in 1998
Spotted Wintergreen		
Chimaphila maculata	COSEWIC	1987; reconfirmed status in 1998
Gattinger's Agalinis		
Agalinis gattingeri	COSEWIC	1988; reconfirmed status in 1999
Skinner's Agalinis		
Agalinis skinneriana	COSEWIC	1988; reconfirmed status in 1999
Bluehearts		
Buchnera americana	COSEWIC	1998

Common and Scientific Names	Designating Authority	Year Designated
Birds[8]		
Acadian Flycatcher		
Empidonax virescens	COSEWIC	1994
King Rail[9]		
Rallus elegans	COSEWIC	1994
Northern Bobwhite		
Colinus virginianus	COSEWIC	1994
Barn Owl (eastern population)[10]		
Tyto alba	COSEWIC	1999
Kirtland's Warbler[11]		
Dendroica kirtlandii	COSEWIC	1999
Prothonatary Warbler[12]		
Prothonataria citrea	COSEWIC	1996
THREATENED		
Vascular Plants		
Blunt-lobed Woodsia		
Woodsia obtusa	COSEWIC	1994
False Hop Sedge		
Carex lupuliformis	COSEWIC	1997
Small-flowered Lipocarpha	COSEWIC	1992
Lipocarpha (Hemicarpha) micrantha	COSSARO	1996
Colicroot	COSEWIC	1988
Aletris farinosa	COSSARO	1996
Purple Twayblade[13]		
Liparis liliifolia	COSSARO	1996
American Chestnut		
Castanea dentata	COSEWIC	1987
Golden Seal	COSEWIC	1991
Hydrastis canadensis	COSSARO	1995
Kentucky Coffee-tree	COSEWIC	1983
Gymnocladus dioicus	COSSARO	1996
Goat's-Rue		
Tephrosia virginiana	COSEWIC	1996
Bird's Foot Violet		
Viola pedata	COSEWIC	1990
Deerberry		
Vaccinium stamineum	COSEWIC	1994
White Wood Aster		
Aster divaricatus	COSEWIC	1995
Amphibians		
Fowler's Toad [14] [15]		
Bufo fowleri	COSEWIC	1999

Common and Scientific Names	Designating Authority	Year Designated
Reptiles		
Eastern Spiny Softshell[16][17]	COSEWIC	1991
Apalone spinifera spinifera	COSSARO	1995
Black Rat Snake		
Elaphe obsoleta	COSEWIC	1998
Eastern Fox Snake		
Elaphe vulpina gloydi	COSEWIC	1999
Queen Snake		
Regina septemvittata	COSEWIC	1999
Eastern Massasauga[18][19]	COSEWIC	1991
Sistrurus catenatus catenatus	COSSARO	1995
Birds		
Peregrine Falcon[20]		
Falco peregrinus anatum	COSEWIC	1999
Barn Owl (eastern population)[21]		
Tyto alba	OMNR	1984
Hooded Warbler		
Wilsonia citrina	COSEWIC	1994
VULNERABLE		
Vascular Plants		
Broad Beech Fern		
Phegopteris hexagonoptera	COSEWIC	1983
Hill's Pondweed		
Potamogeton hillii	COSEWIC	1986
Few-flowered Club-rush		
Scirpus verecundus	COSEWIC	1986
Green Dragon		
Arisaema dracontium	COSEWIC	1984
Wild Hyacinth		
Camassia scilloides	COSEWIC	1990
Round-leaved Greenbrier[22]		
Smilax rotundifloia	COSSARO	1995
Eastern Prairie White Fringed Orchid		
Platanthera leucophaea	COSEWIC	1986
Shumard Oak		
Quercus shumardii	COSEWIC	1984; reconfirmed status in 1999
Dwarf Hackberry		
Celtis tenuiflolia	COSEWIC	1985
False Rue-anemone		
Isopyrum biternatum	COSEWIC	1990
Climbing Prairie Rose		
Rosa setigera	COSEWIC	1986
Hop Tree		
Ptelea trifoliata	COSEWIC	1984

Common and Scientific Names	Designating Authority	Year Designated
Swamp Rose Mallow		
Hibiscus moscheutos	COSEWIC	1987
Branched Bartonia		
Bartonia paniculata	COSEWIC	1992
American Columbo		
Frasera caroliniensis	COSEWIC	1993
Blue Ash[23]		
Fraxinus quadrangulata	COSSARO	1996
American Water-willow[24]		
Justicia americana	COSSARO	1996
Indian Plantain		
Cacalia plantaginea	COSEWIC	1988; reconfirmed status in 1999
Willow Aster		
Aster praealtus	COSEWIC	1999
Crooked-stemmed Aster		
Aster prenanthoides	COSEWIC	1999
Western Silver-leaf Aster		
Virgulus (Aster) sericeus	COSEWIC	1988
Dense Blazing Star		
Liatris spicata	COSEWIC	1988
Amphibians		
Smallmouth Salamander		
Ambystoma texanum	COSEWIC	1991
Reptiles		
Spotted Turtle[25]	COSEWIC	1991
Clemmys guttata	COSSARO	1995
Wood Turtle [26] [27]	OMNR	1985
Clemmys insculpta	COSEWIC	1996
Five-lined Skink[28]		
Eumeces fasciatus	COSEWIC	1998
Eastern Hognose Snake[29]	COSSARO	1996
Heterodon platirhinos	COSEWIC	1997
Butler's Garter Snake		
Thamnophis butleri	COSEWIC	1999
Birds		
Least Bittern		
Ixobrychus exilis	COSEWIC	1988; reconfirmed status in 1999
Red-shouldered Hawk	COSEWIC	1983; reconfirmed status in 1996
Buteo lineatus	COSSARO	1995
Yellow Rail		
Coturnicops noveboracensis	COSEWIC	1999
Caspian Tern		
Sterna caspia	COSEWIC	1978

Common and Scientific Names	Designating Authority	Year Designated
Black Tern[30]		
Chlidonias niger	COSSARO	1996
Short-eared Owl		
Asio flammeus	COSEWIC	1994
Great Gray Owl[31]		
Strix nebulosa	COSSARO	1996
Red-headed Woodpecker	COSSARO	1996
Melanerpes erythrocephalus	COSEWIC	1996
Prairie Warbler	COSEWIC	1985
Dendroica discolor	COSSARO	1996
Cerulean Warbler	COSEWIC	1993
Dendroica cerulea	COSSARO	1996
Louisiana Waterthrush	COSEWIC	1991; reconfirmed status in 1996
Seiurus motacilla	COSSARO	1995
Yellow-breasted Chat (Eastern)	COSEWIC	1994
Icteria virens	COSSARO	1996
Mammals		
Eastern mole		
Scalopus aquaticus	COSEWIC	1980; reconfirmed status in 1998
Southern Flying Squirrel		
Glaucomys volans	COSEWIC	1988
Woodland Vole		
Microtus pinetorum	COSEWIC	1998
Gray Fox		
Urocyon cinereoargenteus	COSEWIC	1979
Polar Bear		
Ursus maritimus	COSEWIC	1991; reconfirmed status in 1999
Wolverine		
Gulo gulo	COSEWIC	1989
Woodland Caribou[32]		
Rangifer tarandus caribou	COSEWIC	1984
Insects		
West Virginia White[33]		
Artogeia (Pieris) virginiensis	OMNR	1990
INDETERMINATE		
Mammals		
Gray Wolf (eastern population)		
Canis lupus	COSEWIC	1999
Mountain Lion (Eastern Cougar)		
Felis concolor couguar	COSEWIC	1998

Common and Scientific Names	Designating Authority	Year Designated
EXTIRPATED		
Vascular Plants		
Illinois Tick-trefoil		
Desmondium illinoense	COSEWIC	1991
Blue-eyed Mary		
Collinsia verna	COSEWIC	1987
Birds		
Greater Prairie Chicken		
Tympanuchus cupido	COSEWIC	1990
Insects		
Frosted Elfin Butterfly[34]		
Incisalia irus	COSEWIC	1999
Karner Blue Butterfly[35]		
Lycaeides melissa samuelis	COSEWIC	1997

---

[1] Declared in Regulation under the Endangered Species Act, R.S.O. 1990, c. E. 15 in 1978

[2] Designated as nationally threatened in 1989 by COSEWIC and provincially threatened by COSSARO; uplisted to nationally endangered in 1999

[3] Designated as nationally threatened by COSEWIC in 1988; uplisted to nationally endangered in 1999

[4] Designated as nationally threatened by COSEWIC in 1988; uplisted to endangered in 1999

[5] Designated as nationally threatened in 1988; uplisted to endangered in 1999

[6] Declared in Regulation under the Endangered Species Act, R.S.O. 1990, c.E. 15 in 1987

[7] Designated as nationally threatened by COSEWIC in 1987; uplisted to endangered in 1999

[8] Recorded present in Ontario with breeding occurrences primarily in the southwestern portion of the province (Cadman, M. D., P. F. J. Eagles and F. M. Helleiner. 1988. Atlas of the breeding birds of Ontario. Federation of Ontario Naturalists and the Long Point Bird Observatory. University of Waterloo Press).

[9] Designated as nationally vulnerable by COSEWIC in 1985; uplisted to nationally endangered in 1994.

[10] Designated as provincially threatened by OMNR in 1984; designated nationally vulnerable by COSEWIC in 1984; uplisted to nationally endangered by COSEWIC in 1999.

[11] Declared in Regulation under the Endangered Species Act, R.S.O. 1990, c. E. 15 in 1978.

[12] Designated as nationally vulnerable by COSEWIC in 1984; uplisted to nationally endangered in 1996.

[13] Designated as provincially threatened by COSSARO in 1996; designated nationally threatened by COSEWIC in 1989; uplisted to nationally endangered by COSEWIC in 1999.

[14] Designated nationally vulnerable by COSEWIC in 1986; uplisted to nationally threatened by COSEWIC in 1999.

[15] Fowler's toad is protected in Regulation under the Fish and Wildlife Conservation Act..

[16] Eastern Spiny Softshell is protected in Regulation under the provincial Fish and Wildlife Conservation Act.

[17] COSSARO reconfirmed the OMNR status of provincially threatened.

[18] The Eastern Massasauga is protected in Regulation under the provincial Fish and Wildlife Conservation Act

[19] COSSARO reconfirmed the OMNR status of provincially threatened.

[20] Subspecies Falco peregrinus anatum designated as nationally endangered in 1978; downlisted to nationally threatened by COSEWIC in 1999; COSEWIC downlisted F. p. tundrius from nationally threatened to nationally vulnerable in 1992; all subspecies of F. peregrinus covered in Regulation under the Endangered Species Act, R.S.O. 1990, c. E. 15 in 1973.

[21] Eastern population of Barn Owl was designated as provincially threatened by OMNR in 1984; designated nationally vulnerable by COSEWIC in 1984; uplisted to nationally endangered by COSEWIC in 1999.

[22] Ontario populations designated as nationally threatened by COSEWIC in 1994. COSSARO reviewed the scientific evidence against its Criteria in January 1995 and October 1995 and determined that a status of provincially vulnerable is warranted.

[23] Designated nationally threatened by COSEWIC in 1983. COSSARO reviewed the scientific evidence against its Criteria in July 1996 and determined that a status of provincially vulnerable is warranted.

[24] Designated nationally threatened by COSEWIC in 1984. COSSARO reviewed the scientific evidence against its Criteria in July 1996 and determined that a status of provincially vulnerable is warranted.

[25] Spotted Turtle is protected in Regulation under the Fish and Wildlife Conservation Act.

[26] Wood Turtle is protected in Regulation under the Fish and Wildlife Conservation Act.

[27] COSSARO was formed pursuant to the designation of the Wood Turtle by OMNR in 1985.

[28] Five-lined Skink is protected in Regulation under the Fish and Wildlife Conservation Act.

[29] Eastern Hognose Snake is protected in Regulation under the Fish and Wildlife Conservation Act.

[30] Designated as "not at risk" nationally by COSEWIC in 1996. This reconfirmed the committee's 1978 designation of "not in any category". COSSARO has reviewed the data for Ontario and considers that a designation of provincially vulnerable is warranted.

[31] Designated as nationally rare (vulnerable) by COSEWIC in 1979, and delisted in 1996. The Great Gray Owl is retained on OMNR's list of provincially vulnerable species pending further consideration by COSSARO.

[32] "Western population" of Woodland Caribou designated as nationally vulnerable by COSEWIC in 1984. Ontario population is considered part of this population.

[33] In 1990 OMNR removed the Western Virginia White from Regulations under the Endangered Species Act, R.S.O. 1990, c. E. 15. A status of provincially vulnerable is assigned pending further review.

[34] Declared in Regulation under the Endangered Species Act, R.S.O. 1990, c. E. 15 in 1990.

[35] Declared in Regulation under the Endangered Species Act, R.S.O. 1990, c. E. 15 in 1990.

APPENDIX Q

Evaluation Criteria for Significant Wildlife Habitat

This appendix is made up of four tables. They are as follows:

Table Q - 1: Evaluation Criteria for Seasonal Concentration Habitats

Table Q – 2: Evaluation of Rare Vegetation Communities or Specialized Wildlife Habitats

Table Q – 3: Evaluation Criteria for Species/Habitats of Conservation Concern

Table Q - 4: Evaluating the Significance of Animal Movement Corridors.

These tables provide extensive lists of criteria that can be used to evaluate various significant wildlife habitats. It is not essential that all criteria be used to evaluate every habitat. The evaluator should focus on those criteria they feel are most appropriate to their situation.

Table Q-1: Evaluation Criteria for Seasonal Concentration Habitats

Specific Habitat	Suggested Criteria	Guidelines for Evaluation
Winter deer yards	• relative importance of yard to local deer population • population size of deer supported by the site • size of the site • distribution of yards • quality of habitat • location of yard • historical use • importance of the winter yard to other wildlife • degree of disturbance	• The yard is most significant if it is the only one in the planning area; it is significant if it is one of only a few in the area. • Heavily populated sites are the most significant. • Larger sites are usually more significant than smaller sites. • In areas where there are no clearly delineated large yards, smaller, more loosely aggregated yards are collectively significant. • Significant sites have denser conifer cover (i.e., > 60% canopy closure), more woody browse in the core area, and good foraging on adjacent lands (e.g., agricultural crops, acorns). • Significant sites have no barriers to safe movement by deer to and from the yard, and are located within a landscape providing cover and food. • Most significant yards will have a long history of use (e.g., at least 10 years). • Significant yards provide important habitat for other mammals and birds. • More significant yards will be less disturbed.
Moose late winter habitat	• relative importance of the area to local moose population • quality of habitat • location of habitat • degree of disturbance • historical use • importance of the winter habitat to other wildlife	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites have denser conifer cover (i.e., > 60% canopy closure and large conifers) with abundant woody browse in the understorey. • Most significant sites are surrounded by forest, with some open areas or south-facing slopes in the vicinity, and no barriers to safe movement to and from the site. • Most significant sites are less disturbed. • Most significant sites have a long history of use (e.g., at least 10 years). • Significant sites provide important habitat for other mammals and birds.
Colonial bird nesting sites	• relative importance of the site to local bird populations • presence of species of conservation concern • number of nests in the colony • species diversity • quality of habitat • size of site • level of disturbance • historical use	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support several species of concern; significant sites support one species. • Sites with the greatest number of nests are more significant. • Sites with the greatest number of species are more significant. • Significant sites generally have better habitat (e.g., optimal vegetation composition, ratio of open water to emergent vegetation; stable water level; abundant food) capable of supporting more birds for a longer time period.

Specific Habitat	Suggested Criteria	Guidelines for Evaluation
	• potential concerns of the planning authority	• Larger sites may be more significant (especially for area-sensitive species). • Least disturbed sites are more significant. • Sites with a longer history of use may be more significant. • Suggested number of nests that should be considered significant: Great Blue Heron, 25; Black-crowned Night-Heron, 25; Green Heron, 10; Great Egret, 5; Great Black-backed Gull, 5; Herring Gull, 100; Bonaparte's Gull, 10; Little Gull, 1; Caspian Tern, 75; Common Tern, 100; Black Tern, 10; Forster's Tern, 5 (excluding Lake St. Clair); Cliff Swallow, 8; Bank Swallow, 100; Northern Rough-winged Swallow, 10; Yellow-headed Blackbird, 10; Brewer's Blackbird, 5. • Where their populations are very high, even large colonies of Ring-billed Gulls may not be considered significant.
Waterfowl stopover and staging areas	• relative importance of the site to local waterfowl populations • presence of species of conservation concern • species diversity • abundance • quality of habitat • size of site	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support several species of concern; significant sites support one species. • Sites with the greatest number of species are more significant. • Sites with the highest number of individuals are more significant. • Trumpeter Swans and Ruddy Ducks have limited staging areas in Ontario, and their regular use of the habitat should be considered significant. • Regular staging areas for Canvasbacks and Redheads should be considered significant. • Significant sites generally have better habitat (e.g., optimal vegetation composition, ratio of open water to emergent vegetation; extensive shoreline; abundant food, nocturnal roosting cover) • Larger wetlands are more significant.
Waterfowl nesting areas	• relative importance of the site to local waterfowl populations • presence of species of conservation concern • species diversity • abundance • size of area • quality of habitat • location of site • nest predation • level of disturbance	• Most significant sites are the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support several species of concern; significant sites support one species. • Sites with the greatest number of species are more significant. • Sites with nesting and brood habitat for American Black Ducks should be considered significant • All nesting areas for Gadwall, Green-winged Teal, Northern Pintail, Northern Shoveler, and American Wigeon should be considered significant • Sites with the highest number of individuals are more significant.

Specific Habitat	Suggested Criteria	Guidelines for Evaluation
		• Larger sites of suitable habitat (e.g., grasslands adjacent to wetlands, ponds, lakes for many species) are more significant. • Most significant sites have better habitat (e.g., optimal vegetation structure, stable water levels, abundant cover, and a wetland/water body within 150 m). • Sites providing safe movement of broods from nest to wetland/water body (i.e., no roads) are more significant. • Sites with lower rates of nest predation are more significant. • Sites with little disturbance (e.g., haying, cattle grazing) are more significant.
Shorebird migratory stopover areas	• relative importance of the site • presence of species of conservation concern • species diversity • abundance • size of site • historical use of site • level of disturbance	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area; artificial sites (e.g., sewage lagoons) may be significant in some areas. • Most significant sites support several species of concern; significant sites may support one species. • Sites with the greatest number of species are more significant. • Sites with the highest number of individuals are more significant. • Large sites are more significant than smaller sites. • Sites that have been used for many years are more significant. • Least disturbed sites may be more significant.
Landbird migratory stopover areas	• relative importance of the site • presence of species of conservation concern • species diversity • abundance • size of site • habitat diversity • historical use of site • location of site	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support several species of concern; significant sites support one species. • Sites with the greatest number of species are more significant. • Sites with the highest number of individuals are more significant. • Large sites are more significant than smaller sites. • Sites with a variety of habitat types (e.g., forest, grassland) are often more significant than sites with homogeneous habitat. • Sites that have been used for many years are more significant. • Sites within 5 km of Lake Ontario and Lake Erie shoreline are most significant.
Raptor winter feeding and roosting areas	• relative importance of the site • presence of species of conservation concern • species diversity	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support several species of concern; significant sites support one species. • Sites with the greatest number of species are more

Specific Habitat	Suggested Criteria	Guidelines for Evaluation
	- abundance - size of site - level of disturbance - location of site - habitat quality - historical use of area	significant. - Sites with the highest number of individuals are more significant. - Large sites (e.g., at least 20 ha) are more significant than smaller sites. - Least disturbed sites may be more significant. - Sites located near other open field areas, with adjacent woods are more significant. - Sites with better habitat (e.g., abundant prey and perches; a tendency toward less snow accumulation due to exposure to strong prevailing winds) are probably more significant. - Significant sites may have been used for several years and/or at least 60% of winters.
Bald Eagle winter feeding and roosting areas	- relative importance of the site - abundance - size of site - habitat quality - level of disturbance - location of roost - historical use of area	- Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. - Sites with the highest number of individuals are most significant. - Large sites are more significant than smaller sites. - Sites with better habitat (e.g., abundant open water and fish, extensive large trees and snags) are more significant. - Least disturbed sites may be more significant. - Sites adjacent to prime hunting area are often more significant. - Most significant sites have been used for several years and/or at least 60% of winters.
Wild Turkey winter range	- relative importance of the site - abundance - size of site - habitat quality - location of habitat - level of disturbance	- Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. - Sites with the highest number of individuals are most significant. - Large sites are more significant than smaller sites. - Sites with better habitat (e.g., extensive large conifer trees, springs and seeps) are more significant. - Sites located in valleys or lower south-facing slopes, close to foraging areas (e.g., farm fields, oak woods) and water may be more significant. - Least disturbed sites may be more significant.
Turkey Vulture summer roosting areas	- relative importance of the site - abundance - level of disturbance - historical use of area	- Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. - Sites with the highest number of individuals are most significant. - Least disturbed sites may be more significant. - Sites that have been traditionally used for at least 10 years are more significant.

Specific Habitat	Suggested Criteria	Guidelines for Evaluation
Reptile hibernacula bat hibernacula	• relative importance of the site • presence of species of conservation concern • species diversity • abundance • habitat quality • location of site • level of disturbance	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support two or more species of concern; significant sites may support one species. • Sites with the greatest number of species are more significant. • Sites with the highest number of individuals are more significant. • The following numbers of bats should be considered significant at maternity colonies and winter roosts, respectively: big brown bat, 30, 30; little brown bat, 100, 50; eastern pipistrelle, 10, 20; silver-haired bat, 10, N/A; long-eared bat, 10, 20; small-footed bat, 10, all sites. • Sites with better habitat (e.g., bats- deep cave with small entrance, water, abundant roosting area inside cave) are probably more significant. • Sites located within or adjacent to large areas of suitable habitat (e.g., forests) are more significant; for reptiles, sites found in areas with good movement corridors are more significant. • Least disturbed sites are more significant.
Migratory butterfly stopover areas	• relative importance of the site • presence of species of conservation concern • species diversity • abundance • size of site • habitat diversity • location of site • level of disturbance • historical use of area	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Most significant sites support two or more species of concern; significant sites may support one species. • Sites with the greatest number of species are more significant. • Sites with the highest number of individuals are more significant. • Large sites are more significant than smaller sites. • Sites with a variety of habitat types (e.g., forest, grassland) are often more significant than sites with homogeneous habitat. • Sites within 5 km of Lake Ontario and Lake Erie shoreline are most significant. • Least disturbed sites may be more significant. • Sites that have been traditionally used for at least 10 years are more significant.
Bullfrog habitat	• Relative importance of the habitat to local populations • Abundance • Size of site • Historical use of area	• Significant sites are generally the only known sites in the planning area; significant sites may be one of only a few in the area. • Sites with the highest number of individuals are more significant. • Large sites with suitable habitat are more significant than smaller sites. • Most significant areas have supported bullfrogs for at least 10 years.

Table Q-2: Evaluation of Rare Vegetation Communities or Specialized Wildlife Habitats

Important Evaluation Criteria	Suggested Guidelines
Rare Vegetation Communities	
Current representation of community type within the planning area	• Vegetation communities with the poorest current representation within the planning area are most significant. • As much of each identified rare vegetation community should be represented as many times as possible (e.g., protect at least three examples of each identified rare community type in the planning area where no such protected sites currently exist). • Rare communities that could be lost or severely degraded and cannot be replaced by similar sites in the planning area, are highly significant.
Degree of rarity (e.g., presence of rare or uncommon species and/or endemic species)	• Highest priority for protection should be given to all provincially rare communities (e.g., S1, S2, S3 ranking) identified by the NHIC (Bakowsky, 1996). In most cases some or all of these sites should be protected. • All prairie and savannah remnants (S1 ranked) identified by the municipality should be protected because these communities are very rare throughout the province. See Appendix J. for a list of provincially rare vegetation communities in Southern Ontario. • The next priority is to identify, evaluate, and protect vegetation communities that are rare in the municipality. The planning authority might adopt criteria developed by the Nature Conservancy for determination of local rarity (e.g., communities that represent < 3% of remaining natural area and/or are found in only five or fewer locations within the municipality might be considered locally significant communities).
Diversity of site	• Sites with more than one rare vegetation community, higher plant species diversity, and/or supporting a number of rare species are more significant.
Condition of community	• In general, the highest quality representatives of rare community types are most significant unless only poor quality examples remain in the planning area. Some evaluation criteria to determine the relative quality of these communities might include: percentage of non-native species, percentage of indicator species, or relative abundance of associated features (e.g., large trees and/or older age classes of trees). Identified communities can be compared to the ELC community descriptions. • Undisturbed or least disturbed communities are more significant (e.g., no roads or infrequently used roads; no pollution, forestry operations, maple syrup production, grazing, human refuse; high level of human use; high proportion of non-native species).
Size and location of site	• The largest sites and sites that are part of large natural areas are generally most significant.
Potential for long-term protection of the site	• Sites that provide the best opportunity for long-term protection are usually more significant than similar sites with little opportunity for protection or facing an uncertain future due to potential threats (e.g., site in a large natural area versus an isolated site close to an expanding residential development). • Rare communities threatened with degradation or loss are more significant than similar, but currently unthreatend rare communities, if they can be protected.

Important Evaluation Criteria	**Suggested Guidelines**
Provision of significant wildlife habitat	• Rare communities providing identified significant wildlife habitat (e.g., hunting areas for raptors, nesting areas for waterfowl or grassland birds, foraging areas for shorebirds, food sources for rare butterflies) are most significant.
Specialized Habitats for Wildlife	
Sites supporting area-sensitive species	
Presence of rare, uncommon, or declining species	• Sites supporting area-sensitive species of birds that are rare or uncommon, and/or exhibiting population declines provincially are most significant.
Overall area of site	• Largest natural forest stands in the municipality are likely most significant with those >30 ha being most likely to support and sustain a diversity of these birds. • Largest grasslands in the municipality are likely most significant with those >30 ha most likely to support and sustain diversity of these species.
Area of forest interior contained within the forest stand	• Most significant forest stands should contain at least 10 ha of forest interior excluding at least a 200m buffer around the forest interior. • Smaller interior habitats may still be significant where no larger examples exist.
Age and tree composition of forest stand	• Sites with an abundance of large (e.g., >40 cm DBH, >25 m tall), mature trees are more significant for certain nesting raptor species as well a number of songbird species.
Amount of vertical stratification of site	• Forests and grasslands with a variety of different layers of vegetation at different heights likely provide more habitats and support more bird species and are consequently more significant. • Uneven-aged forests are generally more significant than even-aged forests because they provide more forest structure.
Amount of contiguous closed-canopy/open areas in forest stand	• Sites with largest contiguous canopy cover and fewest gaps in the canopy are likely most significant. Natural gaps (e.g., windthrown trees, woodland ponds) are preferred to man-made gaps (e.g., roads). • Gaps should be < 20 m including roads and rights-of-way.
Degree of disturbance on site e.g., roads, forestry management and operations, grazing, crop production	• Roadless, relatively undisturbed sites with no history of disturbance from grazing, forestry operations during the last 20 years are most significant. • Sites with history of only light grazing and/or forestry operations over the last 20 years are potentially significant if properly managed. • Uneven-aged forest stands are often more significant than even-aged forest stands because they may be less intensively managed, and generally contain a natural representation of species. • Forest stands with a history of little or no forest management may be most significant. • In general, early successional grasslands that are not being used for agricultural production are more significant that similar grasslands that are used for agriculture (e.g., crops, cattle grazing).
Amount of adjacent residential development	• Sites with the least amount of adjacent residential development are more significant.
Current representation of specialized habitat in planning area	• Sites that could be lost or severely degraded and cannot be replaced by similar sites in the planning area, are highly significant. • Specialized habitats with the poorest current representation within the planning area are significant.
Provision of significant wildlife habitat	• Sites providing several identified significant wildlife habitats (e.g., raptor nest sites, rare vegetation community, habitat for species of conservation concern) are most significant.

Important Evaluation Criteria	**Suggested Guidelines**
Potential for long-term protection of the site	• Sites that provide the best opportunity for long-term protection are usually more significant than similar sites with little opportunity for protection or facing an uncertain future due to potential threats (e.g., site in a large natural area versus. an isolated site close to an expanding residential development). • Habitats threatened with degradation or loss are more significant than similar, but currently unthreatend habitats, if they can be protected.
Forest stands providing a diversity of habitats (e.g., tree cavities, fallen logs, vertical stratification)	
Provision of significant wildlife habitat	• Stands providing several significant wildlife habitats (e.g., forest interior habitat, raptor nesting, rare community) are most significant.
Size of site	• Large sites are likely most significant. • Small sites are significant if no large sites exist in the planning area.
Age, condition of trees on site	• Sites with a wide variety of age classes of trees are likely most significant for provision of a variety of habitats. • Sites with a high proportion of old or mature trees, and/or diseased or damaged trees are likely more significant because they provide more organic ground structure. • Uneven-aged forest stands are likely more significant than even-aged forest stands because uneven-aged management often results in retention wildlife habitat and they are often less disturbed by management activities.
Vegetation composition and diversity of site	• Sites with a diversity of tree and shrub species provide more understorey structure and consequently are more significant. • Sites with a high proportion of aspens, beech, basswood, conifers are likely most significant for tree cavity production. • Sites with majority of cavities located in living trees are likely more significant because these trees last longer than dead cavity trees. • Sites with cavities in living trees that also produce abundant mast (e.g., oak, beech, walnut, black cherry) are more significant. • Sites with variety of tree species (e.g., hardwoods such as maple, oak, softwoods such as poplar, conifers) are more significant because some cavities can be created quickly (e.g., in softwoods) and some will last longer (e.g., in hardwoods).
Cavity size, abundance, and location	• Sites containing a diversity of cavity sizes to meet the nesting, denning, foraging and resting habitat requirements of a variety of species are likely most significant. • Sites with trees with large cavities are more significant than sites with trees with mainly small cavities. OMNR forestry tree-marking guidelines suggest retention of 6 cavity trees/ha with at least one large cavity tree (>50 cm diameter at breast height) per ha and the other 5 trees with at least 25 cm DBH. • Generally, cavities in the upper trunk area of trees are more significant than cavities in the lower trunk area.
Location of site	• Sites near water may be more significant (i.e., breeding habitat of forest dwelling amphibians such as some salamanders and frogs is nearby, preferred nesting habitat of some raptors). • Moist soil conditions are attractive to species of amphibians.

Important Evaluation Criteria	**Suggested Guidelines**
History of forest management	• Sites with little or no management may be more significant because often this results in retention of more cavity trees, standing dead trees, vertical stratification, organic ground structure, cavity trees, and standing dead trees that will eventually become decaying woody debris, as well as a greater diversity of trees.
Woodlands supporting amphibian breeding ponds	
Provision of significant wildlife habitat	• Woodlands providing several significant wildlife habitats (e.g., forest interior habitat, raptor nesting, abundant tree cavities and down woody debris) are most significant.
Degree of permanence	• Woodlands with permanent ponds or those containing water in most years until at least mid July are most significant.
Species diversity of pond	• Ponds supporting high species diversity are more significant.
Presence of rare species	• Ponds supporting rare amphibian species are more significant that ponds supporting only common species.
Size and number of ponds	• In general, woodlands with larger and/or several ponds are more significant.
Diversity of submergent and emergent vegetation	• Ponds with a good diversity of emergent and submergent aquatic vegetation are most significant.
Presence of shrubs, logs at edge of pond	• Presence of shrubs and logs increase significance of pond for some amphibian species because of increased structure for calling, foraging, and escape and concealment from predators.
Adjacent forest habitat	• More significant areas will have closed canopy forest providing shaded, moist understorey and abundance of down woody debris for cover habitat. • Breeding ponds with shortest distance to forest habitat are more significant because of reduced risk to moving amphibians and are more likely to be used.
Water quality	• Prefer unpolluted waters.
Level of disturbance	• Woodlands with little or no disturbance (e.g., forest management, roads between breeding pond and forest habitat) are more significant.
Old growth or mature forest stands	
Current representation of old growth or mature forest stands within the planning area	• Due to the rarity and fragmented distribution of old growth forests in southern Ontario, as much of identified sites should be represented as many times as possible (e.g., protect at least three good examples of old growth or mature stands in the planning area where no such protected sites currently exist). • Sites that could be lost or severely degraded and cannot be replaced by similar sites in the planning area, are highly significant.
Age of trees	• Most significant sites will contain numerous trees of at least 140 years old. • Stands containing younger trees (e.g., 100 years or older) are significant where older trees no longer exist. • Stands containing predominantly long-lived trees are probably more significant than stands consisting primarily of short-lived species (e.g., trembling aspen, birch).
Age classes of trees in stand	• More significant sites will contain several distinctly different age classes of trees.
Presence of old growth characteristics	• Most significant sites will exhibit several to all of the following characteristics: broad array of fallen logs in various sizes and stages of decomposition; at least some very large fallen logs; large spectrum of tree sizes, including some very tall trees; some larger trees with more columnar form due to loss of large limbs from past storm damage; numerous snags; some pit and mound ground topography; uneven canopy with scattered gaps due to fallen trees and tree limbs .

Important Evaluation Criteria	Suggested Guidelines
Species diversity	• More significant sites will have a higher diversity of wildlife species because they provide many different habitats and regeneration niches for plants and animals.
Provision of significant wildlife habitat	• Sites providing several significant wildlife habitats (e.g., forest interior habitat, raptor nesting, tree cavities and/or amphibian breeding ponds) are most significant.
Potential for long-term protection of site	• Sites that provide the best opportunity for long-term protection are usually more significant than similar sites with little opportunity for protection or facing an uncertain future due to potential threats (e.g., site in a large natural area versus an isolated site close to an expanding residential development). • Sites threatened with degradation or loss are more significant than similar, but currently unthreatend sites, if they can be protected.
Stand history	• More significant sites will have experienced little or no substantial logging or other forestry activities (e.g., no management or only periodic light selection cutting).
Size and location of site	• The largest sites and sites that are part of large natural areas are generally most significant. • Smaller, isolated sites are significant in areas with little or no remaining examples of old growth or mature woodlands.
Degree of disturbance	• Undisturbed or least disturbed sites are more significant (e.g., no roads or infrequently used roads; no pollution, forestry operations, maple syrup production, grazing, human refuse; high level of human use; high proportion of non-native species).
Foraging areas producing fruit, hard mast (acorns, beechnuts)	
Provision of significant wildlife habitat	• Woodlands providing several significant wildlife habitats (e.g., forest interior habitat, raptor nesting, abundant tree cavities and down woody debris) are most significant.
Area/abundance of food source	• Large areas of fruit-producing shrubs (e.g., blueberries, wild blackberries, serviceberries) and mast-producing trees (e.g., oaks, hickories, beech) are likely most significant because they usually support more wildlife.
Size, age, health of trees	• Sites with a high proportion of healthy, mature trees with large crowns are more significant because these trees generally produce more mast. • Sites with numerous oak trees with 40-65 cm diameter at breast height are significant because such trees can produce heavy acorn crops.
Species diversity of site	• Sites with a variety of mast-producing tree species and/or fruit-producing shrubs are most significant since production by species can vary widely from year to year. • Sites within the Great Lakes-St. Lawrence forest region with abundant and vigorous red oak trees are significant since this species is considered the single most important mast-producing tree species in this region.
Permanence of food source	• Areas providing more long-term, relatively stable food supply are more significant than areas such as clearcuts and burns that provide more temporary sources of food.
Access to foraging areas	• Sites with travel routes that provide cover and reduce mortality risk for wildlife moving to and from foraging areas are most significant. • Sites well removed from people, particularly those used by feeding bears, are more significant because of reduction in wildlife/people interactions.

Important Evaluation Criteria	**Suggested Guidelines**
Consistent historical use by wildlife	• Since food production of such areas varies over time, areas traditionally used by wildlife are probably most significant.
Osprey, Bald Eagle Nesting Habitat	
Access to foraging areas	• Most significant nesting habitats are adjacent or close to relatively clear and shallow (< 1 m) water bodies with productive fish populations.
Presence of large, sturdy trees near shoreline	• Most significant nesting habitats have numerous large conifer and/or deciduous trees in good condition along the shoreline providing birds with good visibility and clear flight line to the nest.
Degree of disturbance	• More significant sites will have no disturbance from human activities within 200 m of the nest during the nesting season. • Some Ospreys may tolerate some disturbance but more significant sites and sites of more sensitive birds should not be disturbed after onset of nesting.
Evidence of use	• Most significant habitat contains several nests within a single area (e.g., within 1 square km) • Sites with current evidence of use are most significant. • Sites with traditional use are most significant (many nests are used for several consecutive years).
Current representation of potential sites	• Potential nesting habitats that could be lost or severely degraded and cannot be replaced by similar sites in the planning area, are significant.
Degree of threat	• Sites threatened with degradation or loss are more significant than similar, but currently unthreatend sites.
Turtle Nesting Habitat	
Size of habitat	• Larger sites are most significant because fewer nests are likely to be lost to predation and larger areas are more likely to be important to larger numbers of turtles.
Location of site	• Nesting areas adjacent to permanent water bodies and large wetlands, and removed from roads are more significant because of increased likelihood of nesting success and hatchlings reaching the water; as well as reduced road mortality. • Higher, well-drained sites are more important than poorly drained, low-lying areas at risk of inundation by water. • Sites with good exposure to sunlight are more significant.
Substrate	• Generally nesting areas of preferred substrate (e.g., sands and gravels) are preferred to sites over other substrates.
Evidence of use	• Presence of several nests or adult females observed during the nesting season, within a single area indicates a significant habitat. • Sites with evidence of use by several species are more significant. • Sites with traditional use are more significant.
Presence of rare species	• Nesting habitats used by rare species are more significant.
Level of predation	• More significant sites are less prone to nest predation (e.g., they are not located in highly active wildlife corridors).
Presence of movement corridor	• Most significant nesting habitats are connected to other turtle habitats (e.g., wetland) by corridors permitting relatively safe movement of these reptiles.

Important Evaluation Criteria	**Suggested Guidelines**
Degree of disturbance	• Nesting habitat that is relatively undisturbed by human activities (e.g., away from busy roads, residential areas) is most significant. • Sites buffered by natural landforms & vegetation are usually more significant than unbuffered, exposed sites because of their superior ability to protect nesting turtles, hatchlings, and nests from natural & human disturbance.
Degree of threat	• Sites threatened with degradation or loss are more significant than similar, but currently unthreatend sites.
Moose aquatic feeding areas	
Abundance of preferred aquatic food plants	• Areas containing abundant pondweeds, yellow waterlily, and milfoil are more significant.
Quality of adjacent forest habitat	• Aquatic feeding areas with dense stands of lowland conifer tree species immediately adjacent to aquatic feeding areas are most significant.
Degree of disturbance of site	• Undisturbed or least disturbed sites are probably significant (e.g., areas with no cottages and boat traffic in the vicinity of feeding areas are preferable).
Access to foraging areas	• Sites with travel routes that provide cover and reduce mortality risk for moose moving to and from aquatic feeding areas are more significant.
History of consistent use	• Sites with record of traditional use by moose are most significant.
Mink and otter feeding/denning sites; marten and fisher denning sites Listed below are suggested guidelines. However, these sites are difficult to find. Therefore knowledge of the most suitable habitat for these mammals may be the most practical way to ensure that some prime habitat is protected.	
Presence of suitable habitat	For mink and otter • Heavily vegetated shorelines, particularly those with abundance of shrubs are more significant. • Shorelines with numerous dead falls, large logs, log jams, and rock piles are more significant because of increased denning sites and because they also provide good habitat for prey species. • Amount of habitat-average mink home range is 316-1,626 ha For marten and fisher • Large contiguous coniferous or mixed forests with abundant large trees (e.g., at least 40 cm diameter at breast height) for maternal denning sites are most significant. • average marten home range is 1.3- 15.7 sq. km; average fisher home range is 17.5- 39 sq. km
Degree of disturbance	• Undisturbed areas with little or no human activity in vicinity are more significant, particularly for otters. • For otters, longer, undeveloped stretches of shoreline habitat are more significant, as well as creek systems joining several ponds.
Size of local fish population	• Water bodies producing large populations of fish (e.g., mesotrophic lakes) are more likely to sustain otters over the long-term than unproductive waters (e.g., oligotrophic lakes).
Areas of high diversity	
Current representation of such areas in the planning area	• Most diverse areas known for the planning area should be considered most significant until inventory information reveals more diverse areas.

Important Evaluation Criteria	**Suggested Guidelines**
Natural community diversity	• Sites with high community diversity (e.g., site containing several different wetland types and/or forested uplands, open uplands, and grasslands) are generally more significant that sites with only one community and are usually more species rich than sites consisting of single communities.
Species diversity	• Usually a community with high species diversity is more significant than a similar community supporting fewer species.
Presence of rare species	• Sites supporting rare or uncommon species are more significant than those that support only common species.
Size of site	• Larger sites are generally more diverse and consequently more significant than similar, but considerably smaller sites.
Seeps/springs	
Abundance of seeps/springs	• Sites with several seeps/springs (e.g., >5) are most significant.
Duration of surface water	• Most significant seeps/springs are present even during very dry summers.
Nature of adjacent area	• Most significant sites support diversity of native vegetation.
Presence of rare species	• Sites supporting rare or uncommon species (e.g., plants, salamanders), or species that are unique to the area (e.g., Wild Turkey) are more significant than those that support only common species.
Location of seeps/springs	• Seeps/springs located on south-facing slopes are probably more significant than seeps with other aspects because of their winter value to some wildlife species. • Seeps/springs in forest stands and/or headwater areas are generally more significant than those found in other areas. • Seeps/spring found in relatively undisturbed areas are generally more significant that those found in areas disturbed by human activities (e.g., off-road vehicle travel).
Cliffs	
Current representation of cliffs within planning area	• Consider as significant, relatively pristine cliffs that are currently unprotected and occur at less than 4 locations in the planning area.
Provision of significant wildlife habitat	• Most significant sites will provide several significant wildlife habitats (e.g., reptile hibernacula, nesting sites, resting sites for Turkey Vultures, migratory bird stopover area, unique vegetation community).
Diversity of habitat features associated with cliff	• Most significant sites will have a variety of habitat features including the presence of large rocks, crevices, caves, water for hibernacula; overhangs, flat ledges of at least 1 square meter for nesting birds; presence of a buffer (for nesting raptors); presence of mature/large trees on summit.
Current or historical use by wildlife species	• Most significant sites will have active eyries or hibernacula. • Significant sites will have historical record of presence of eyries or hibernacula.
Species diversity	• Most significant cliffs have higher associated plant diversity than similar cliffs.
Presence of rare species	• Cliffs supporting rare or uncommon species are more significant than those that support only common species.
Human disturbance	• More significant sites are relatively undisturbed due to their inaccessibility.
Size and location of cliff	• Most significant sites will be within a larger natural area. • South-facing cliffs may be more significant due to greater diversity of associated plant species.

Important Evaluation Criteria	Suggested Guidelines
• **Caves**	
Solution versus physical (e.g. fissured, rock piles, abandoned mine)	• Solution caves are generally more significant than other caves types. • Abandoned mines may be significant to bats in areas with few or no natural caves.
Size of opening	• Caves with small openings may be more important to wildlife (e.g., bats) than caves with large openings permitting entry by humans.
Depth of cave	• Most significant caves have the greatest interior depth.
Ambient winter temperature	• Most significant caves have an ambient winter temperature slightly above freezing.
Ambient relative humidity	• Most significant caves have an ambient winter relative humidity above 90%.
Presence of water	• Most significant caves have some water supplies for hibernating species.
Human disturbance	• Most significant caves are undisturbed due to poor access.

Table Q-3: Evaluation Criteria for Species/Habitats of Conservation Concern

Criteria for Identification of Species/Habitats of Conservation Concern	Suggested Guidelines for Evaluation of Habitats of Species of Conservation Concern
Degree of rarity of species found at site	• Habitats of the rarest species are more significant than those of less rare species. For example, habitats for species ranked S1and S2 should be considered more significant than habitats for species ranked S3. Species ranked as vulnerable by the OMNR should also be considered significant. • Less rare species and their habitats in the planning area may be deemed species of conservation concern by the municipality based on such factors as the number of known occurrences, total extent of remaining habitat, degree of threat or risk to habitat, and/or local interest in a particular species. • If a species' habitat is to be protected, sufficient area (based on the species' known requirements) should be retained to ensure a viable and sustainable population.
Documented significant decline in a species and/or its critical habitat	• The habitat for species experiencing the greatest declines is most significant. • The habitat for declining species that has the lowest representation in the planning area is more significant. • Those habitats that provide the best opportunity for the long-term sustainability of the declining species are most significant (e.g., large well-protected sites; sites that best meet the species' habitat requirements; sites with good connections to other similar habitats).
Species whose range is solely or primarily found in Ontario (i.e., provincial responsibility)	• Habitat for those species with the poorest representation within the planning area is more significant. • These species and their habitats are significant even if well represented in the planning area, due to high provincial responsibility for their protection. • Those habitats that provide the best opportunities for the long-term sustainability of the target species are most significant (e.g., large well-protected sites; sites that best meet the species' habitat requirements; sites with good connections to other similar habitats).

Criteria for Identification of Species/Habitats of Conservation Concern	Suggested Guidelines for Evaluation of Habitats of Species of Conservation Concern
Condition of existing habitat at site	• Sites that provide habitat that best meets the survival requirements of the target species and that also include a natural buffer zone are most significant (i.e. most likely to sustain species/population over the long-term). • Sites that contain the fewest non-native species of potential threat to the target species are significant. • Undisturbed or least-disturbed habitats (e.g., no/few deleterious impacts from roads, human activities) are significant. • Sites capable of producing a large number of individuals of a single species of conservation concern are significant. • Highly diverse sites that support one or more species of conservation concern are most significant.
Size of species population at site	• Habitats supporting large populations of a several species of conservation concern are most significant. • Habitat supporting large populations of a single species is significant.
Size and location of habitat	• Large sites supporting large populations of several species of conservation concern are most significant. • Large sites are generally more significant than most comparable but smaller sites. • Sites large enough to ensure long-term support and viability of species of conservation concern are significant. • Sites with large areas of suitable habitat that are also connected to other potentially suitable habitat and/or natural areas are most significant.
Potential for long-term protection of the habitat	• Habitats that provide the best opportunity for long-term protection are usually more significant than similar habitats with little opportunity for protection or facing an uncertain future due to potential threats (e.g., habitat found in a large natural area vs. an isolated site close to an expanding residential development). • Habitats threatened with degradation or loss are more significant than similar, but currently unthreatend habitats, if they can be protected. • Habitats of species currently experiencing severe population declines in Ontario (e.g., grassland bird species) due to habitat loss are most significant. • Habitats of species currently experiencing significant population declines in the municipality are significant.
Representation of species/habitat within the municipality	• Poorly represented habitats for species of conservation concern are significant. • Habitats that could be lost or severely degraded and cannot be replaced by similar habitats in the planning area, are highly significant.
Evidence of use of the habitat	• Sites with documented traditional use by species are most significant.
Species of particular interest to the planning authority (e.g., the CAC may recommend certain species such as indicator species)	• Sites providing the best examples of habitat that will ensure the long-term sustainability of the species are significant.

Table Q-4: Evaluating the Significance of Animal Movement Corridors

Criteria	Suggested Guidelines for Evaluation of the Significance of Movement Corridors
Importance of areas to be linked by corridor	• Corridors linking the most significant natural areas both in and outside the municipality are most significant (e.g., wetlands, ANSIs in municipality, important waterfowl staging areas). • Corridors that provide access to and from the most critical habitats within a species/ home range are significant. • Corridors connecting locally important conservation areas and/or currently unevaluated natural areas in the planning area may be significant, particularly if the adjacent landscape is greatly fragmented by roads, residential development, or agricultural activities.
Importance of corridor to survival of target species	• Corridors linking most significant or critical identified wildlife habitats for a target species are most significant (e.g., winter deer yards and summer feeding areas, spring breeding ponds and summer woodlands for some species of amphibians). Animals must be able to get to and from their critical habitats.
Dimensions of corridor	• Wider corridors are usually more significant than narrow ones because they generally provide more food and habitat for more species and better protection from predation, natural and human disturbance. Most significant woodland corridors should be at least 200 m wide. • Shorter corridors are usually more significant than longer ones because they minimize the time animals spend in the corridor and the mortality risks to moving animals.
Continuity of corridor	• Continuous corridors consisting of native vegetation, unbroken by roads, or other gaps such as fields, water bodies, residential areas are most significant. • Corridors with few small gaps and crossed by small, infrequently used roads are more significant than corridors containing numerous small gaps and crossed by busier roads. Gaps should be < 20 m.
Habitat and habitat structure of corridor	• Corridors with several layers of vegetation (e.g., mature tall trees, understorey trees, shrubs, herbaceous ground cover) are generally more significant than corridors with few vegetation layers because they provide more cover (therefore protection from adverse weather, predators) for a wider variety of animals and potential sources of food. • Corridors with variety of ground cover (living low vegetation, down woody debris, stumps, rock piles) and subterranean entries are usually more significant than corridors consisting of mostly sparsely covered ground because they provide more and a greater variety of cover. • Corridors through natural landscapes are more significant than those through more anthropogenic landscapes • Corridors with buffers of native vegetation on both sides are more significant than corridors with no natural buffer(s) of native vegetation because they help to reduce impact of natural and human disturbance. Adequate buffers can also reduce predation by raccoons, foxes, cats and other wildlife, on species residing in the corridor; as well as provide a place to feed for small mammals and birds that live in the corridor. Most significant riparian corridors should have at least 15 m of vegetation on both sides of the waterway. • Corridors containing water sources are usually more significant than similar corridors without water because of its importance to a variety of wildlife. • Corridors with fruit and nut-producing vegetation are probably more significant than corridors with no such vegetation because they provide a better food supply for many mammals and birds moving through or living in them. • Corridors that best meet the habitat requirements for the target species are significant.
Species found in corridor or presumed to be using corridor	• Corridors containing high overall species diversity (vegetation, invertebrate, vertebrate species) are probably more significant than corridors with less species diversity. At least some of these species found in a corridor provide food for users of that corridor. Diversity of vegetation also provides cover for more species. Taken together, these factors increase probability that unobserved animals actually use a corridor. • Corridors used for movement by many species are usually more significant than corridors

Criteria	***Suggested Guidelines for Evaluation of the Significance of Movement Corridors***
	used by only a few species. • Corridors used by rare species are significant (e.g., several species of salamander that move between woodlands and their breeding ponds, southern flying squirrel moving between two woodlots). • Corridors providing safe movement for large numbers of a single species (e.g., salamanders) may be significant, especially if few or no other corridors for that species have been identified for the planning area. • Corridors with a high diversity of species permanently residing within corridor are more significant than corridors with few permanent species.
Risk of mortality for species using corridor	• Corridors providing safest passage for wildlife moving across the landscape are most significant. Best corridors will have the lowest risk of mortality associated with them (e.g., from predation, roadkills, or their location with respect to adjacent residential areas with cats, dogs).
Opportunity for protection	• Corridors with the best opportunity for protection (e.g., unopened road allowances, rights-of-way, borders of conservation areas, undeveloped shorelines, hydro and pipeline corridors) are significant. However, this does not imply that more important or better corridors should not be protected simply because these more easily protected corridors are found in the same area.
Provision of other related values	• Numerous and/or large corridors that could effectively increase the overall area of the existing system of protected natural areas in the planning area are significant. • Corridors that could increase local representation and diversity of habitats, successional stages, or area of natural buffer zones are significant. • Corridors that could result in increased foraging opportunities for wide-ranging species (e.g., fisher, black bear) are significant. • Corridors that may permit the future expansion of wildlife populations into an area (e.g., fisher, southern flying squirrel) as habitat for these species improves are significant. • Corridors that could increase or maintain landscape resistance to soil erosion, desiccation, water quality (e.g., riparian corridors along lake shorelines, woodlands) are significant.

APPENDIX R

Summary of Existing Ontario Ministry of Natural Resources Habitat Management Guidelines

Over the past 20 years the Ontario Ministry of Natural Resources has developed a series of forest management guidelines. These guidelines have been developed to assist resource managers to maintain or create a forest that has structure and composition to provide functional habitat for a variety of wildlife species. A variety of constraints and different timber harvest techniques are recommended in the guidelines in order to protect a specific habitat. While these may be considered of limited value to the municipal planning process, the general concepts of forest size, diversity and distribution on a landscape scale are useful. These guidelines offer concise summaries of specific habitat requirements for a number of wildlife species. Habitat requirements for some of these species are very specific (e.g. area sensitive species) while requirements of others may be more general. This information can be applied equally well in the municipal planning process.

Many of the guidelines recommend protecting wetlands and riparian forest areas. These areas provide habitat for a large number of wildlife species. Because of this, many of these areas can be considered significant wildlife habitats (see Tables 10.2 - 10.4 in the text).

Where available, large forest areas will meet habitat requirements of many of the more specialized area sensitive species. The guidelines recommend protecting these areas from fragmentation. Many municipalities do not have large tracts of forest. Instead they may have numerous smaller tracts of forested land that may or may not be interconnected by corridors of forest, thicket or riparian vegetation. The guidelines recommend retaining these corridors, rather than fragmenting the forest landscape further. This may be enough to protect critical habitat of some more specialized, yet adaptable wildlife species.

The concept of establishing buffer zones and timing restrictions for development activities to occur around known significant wildlife habitat is presented in many of these guidelines. Timing restrictions are particularly important during critical life stages (e.g. nesting, calving). All the guidelines provide lists of reference material.

While many of the wildlife species referred to in these guidelines are protected, in varying degrees, by provincial or federal legislation, only those species covered under the *Endangered Species Act* have protection extended to their habitat.

This appendix is arranged into two parts. The first part provides a list of existing guidelines with a short summary of how each may be valuable to the municipal planning process. The second part is a more detailed description of each set of guidelines.

It is important to take into account that many of these guidelines were written in the mid-1980s. Since that time, there have been some changes in landscape ecology concepts. For example, today there is a greater emphasis placed on protecting large, undisturbed tracts of land and lesser emphasis on preserving edge habitat. Even so, all of the guidelines are a good source of information about habitat requirements for many individual species.

When referring to these guidelines, please keep in mind that protecting natural features during forest management activities may be less stringent than those required for urban development. This is because urban developments result in more dramatic and permanent changes to the landscape.

A complete copy of many of these guidelines is available for review at your local Ministry of Natural Resources office. *The Black Rat Snake in Ontario, Rideau Lakes Population*, specific to Kemptville District and *Bird Habitat Guidelines for Forests and Grasslands*, an Illinois document only are available at the Kemptville District Office.

GUIDELINE TITLE	APPLICATION VALUE TO MUNICIPAL PLANNING
Forest Management Guidelines for the Provision of Pileated Woodpecker Habitat (OMNR 1996)	- developed to address Timber Environmental Assessment requirements - intended to ensure adequate representation of mature forest habitat - provides an excellent summary of Pileated Woodpecker behaviour and habitat requirements - particularly useful reference for planning at the landscape scale - application of these guidelines should provide adequate forest habitat for other woodpecker and cavity nesting bird species - also see *Habitat Management Guidelines for Cavity-nesting Birds in Ontario (1984)*
Habitat Management Guidelines for Cavity-nesting Birds in Ontario (OMNR 1984)	- includes provisions for establishing **minimum** forest habitat for 27 cavity-nesting birds - includes habitat descriptions for the following species of woodpeckers: Pileated, Red-headed, Red-bellied, Black-backed, Three-toed, Hairy, Downy, Yellow-bellied Sapsucker, Northern Flicker, Black-capped Chickadee, Boreal Chickadee, Tufted Titmouse, Red-breasted Nuthatch, White-breasted Nuthatch, American Kestrel, Barn Owl, Eastern Screech-owl, Hawk Owl, Barred Owl, Saw Whet, Great Crested Flycatcher, Tree Swallow, Brown Creeper, House Wren, Eastern Bluebird, Prothonotary Warbler
Habitat Management Guidelines for Warblers of Ontario's Northern Coniferous Forests, Mixed Forests of Southern Hardwood Forests (OMNR 1984)	- includes distribution maps and habitat descriptions/ requirements for the following species of warblers: Tennessee, Nashville, Northern Parula, Magnolia, Cape May, Black-throated Blue, Yellow-rumped, Black-throated Green, Blackburnian, Pine, Bay-breasted, Cerulean, Black-and-white, Mourning, Hooded, Canada, American Redstart, Ovenbird, Northern Waterthrush - lists factors affecting management considerations - identifies area-sensitive warbler species (please note: there has been extensive work in this area in recent years; additional species have been identified as area sensitive since the guideline was written)
Bird Habitat Guidelines for Forests and Grasslands (Illinois Department of Conservation undated) Only available through MNR's Science Technology Transfer Unit, Kemptville office *See Web Page* http://www.npwrc.usgs.gov/resource/othrdata/manbook/manbook.htm for a more current version of Illinois guidelines	- augments information provided in *Habitat Management Guidelines for Warblers of Ontario's Northern Coniferous Forests, Mixed Forests of Southern Hardwood Forests (1984)* (includes area requirements for 17 additional forest species not covered in warbler guidelines) - provides estimates of **minimum** areas to sustain viable breeding populations of area sensitive forest (23) and grassland (14) bird species (includes 17 forest species not
Guidelines for the Protection of Forest-nesting and Wetland-nesting Bird Habitat by means of Modified Management Areas (OMNR 1985)	- suggests the expected maximum number of nest sites /9200 ha of land-base for Northern Goshawk, Cooper's Hawk, Sharp-shinned Hawk and Red-shouldered Hawk - recommends buffer zone sizes for Bald Eagle, Osprey and heronries - recommends riparian zone widths according to degree of slope (same as recommended in *Guidelines for Furbearer Management in Ontario* and *Habitat Management Guidelines of Waterfowl in Ontario*) use In conjunction with *Management Guidelines for the Protection of Heronries in Ontario, Management Guidelines and Recommendations for Osprey in Ontario, Habitat Management Guidelines for Ontario's Forest Nesting Accipiters, Buteos and Eagles, Bald Eagle Habitat Management Guidelines, Golden Eagle Habitat Management Guidelines* and *Forest Management Guidelines for the Provision of Pileated Woodpecker Habitat*

GUIDELINE TITLE	APPLICATION VALUE TO MUNICIPAL PLANNING
Habitat Management Guidelines for Waterfowl in Ontario (OMNR 1985)	- includes a description of species habitat requirements for a number of wetland, upland and cavity-nesting waterfowl species - recommends riparian zone widths according to degree of slope (same as recommended in *Guidelines for furbearer habitat management in Ontario, 1985)* - wetland and adjacent land protection measures are intended to provide sufficient protection to wetland and riparian forest-nesting waterfowl
Guidelines for Furbearer Habitat Management in Ontario (OMNR 1985)	- provides description of habitat requirements, effects of habitat alterations and habitat management tactics for both wetland-associated and forest-associated furbearers - recommends riparian zone widths according to degree of slope - wetland and adjacent land protection measures are intended to provide sufficient protection for wetland-associated furbearers
Habitat Management Guidelines for Birds of Ontario Wetlands - including marshes, swamps and fens or bogs of various types (OMNR 1985)	- includes habitat requirement descriptions for the following species: Pied-billed Grebe, Horned Grebe, Red-necked Grebe, American Bittern, Least Bittern, Green Heron, Northern Harrier, Merlin, Yellow Rail, King Rail, Virginia Rail, Sora, Common Moorhen, American Coot, Sandhill Crane, Greater Yellowlegs, Lesser Yellowlegs,, Solitary Sandpiper, Whimbrel, Hudsonian Godwit, Marbled Godwit, Semipalmated Sandpiper, Least Sandpiper, Pectoral Sandpiper, Dunlin, Stilt Sandpiper, Short-billed Dowitcher, Common Snipe, American Woodcock, Wilson's Phalarope, Red-neck Phalarope, Parasitic Jaeger, Little Gull, Common Tern, Forster's Tern, Black Tern, Great Gray Owl, Short-eared Owl, Alder Flycatcher, Eastern Kingbird, Gray Jay, Sedge Wren, Marsh Wren, Swainson's Thrush, Gray Catbird, Cedar Waxwing, Northern Shrike, White-eyed Vireo, Solitary Vireo, Philadelphia vireo, Blue-winged Warbler, Golden-winged Warbler, Yellow Warbler, Palm Warbler, Black-and-white Warbler, Connecticut Warbler, Yellowthroat, Wilson's Warbler, Savannah Sparrow, Le Conte's Sparrow, Sharp-tailed Sparrow, Lincoln's Sparrow, Swamp Sparrow, Yellow-headed Blackbird, Rusty Blackbird, Brewer's Blackbird - wetland and adjacent land protection measures are intended to provide sufficient protection for wetland birds
Management Guidelines for the Protection of Heronries in Ontario (OMNR 1984)	- identifies habitat requirements and sensitivities - particularly useful to identify work or timing restrictions and buffer zones during development in areas close to existing heronries - helps determine suitable distance for development to occur
Management Guidelines and Recommendations for Osprey in Ontario (OMNR 1983)	- identifies habitat requirements and sensitivities - can be used to identify work or timing restrictions and buffer zones during development in areas close to Osprey nesting sites - different restrictions apply for northern and southern Ontario nest sites
Habitat Management Guidelines for Ontario's Nesting Accipiters, Buteos and Eagles (OMNR 1984)	- includes habitat requirement descriptions and distribution maps for the following species: Northern Goshawk, Cooper's Hawk, Sharp-shinned Hawk, Red-shouldered Hawk, Broad-winged Hawk, Bald Eagle
Peregrine Falcon Habitat Management Guidelines (OMNR 1987)	- recommends developing a nest site management plan within a 3 km radius of any nesting site (short outline of plan and description of management options are included)

GUIDELINE TITLE	APPLICATION VALUE TO MUNICIPAL PLANNING
Bald Eagle Habitat Management Guidelines (OMNR 1987)	- provides description of essential habitat, Bald Eagle life history and critical periods during the nesting period - offers recommendations for regional (landscape scale) management that may be of value for municipalities that have known Bald Eagle nesting sites
Golden Eagle Habitat Management Guidelines (OMNR 1987)	- similar to *Bald Eagle Habitat Management Guidelines (1987)* with the exception of offering large clearings beyond the 100 m buffer zone
Forest Management Guidelines for the Provision of Marten Habitat (OMNR 1996)	- provides an excellent summary of marten behaviour and habitat requirements - particularly useful to refer to requirements at the landscape scale - application of these guidelines would provide habitat required by mammals and birds associated with mature –overmature coniferous forests, cavity trees, woody debris
Habitat Management Guidelines for Bats of Ontario (OMNR 1984)	- includes distribution maps, description of habits, diet, habitat requirements - species include: little brown myotis, Keen's myotis, small-footed bat, silver-haired bat, eastern Pipistrelle, big brown bat, red bat, hoary bat - guideline implementation requires knowledge of known roosting, nursery or hibernation sites
Forest Management Guidelines for the Provision of White-tailed Deer Habitat (OMNR 1997)	- excellent summary of winter and summer habitat requirements for deer (note: deer do not yard as readily in southern portions of Ontario unless the winter is severe) - protection of deer habitat will protect habitat for other wildlife species that rely on mast producing trees and plants and require connectivity between forest patches
Forest Management Guidelines for the Provision of Moose Habitat (OMNR 1988)	- wetland and adjacent land (120 m) protection measures will go a long way to protecting moose feeding areas - provides recommendation for no development areas adjacent to critical mineral lick or calving sites
The Black Rat Snake in Ontario, Rideau Lakes Population (OMNR 1977) - A Field Guide Copy available for viewing at Kemptville District Office or from the Science and Technology Transfer Unit, Kemptville	- not a guideline document - provides concise description on range, habitat, prey hibernation, reproduction of black rat snake - specific population information limited to eastern Ontario

Forest Management Guidelines for the Provision of Pileated Woodpecker Habitat
Version 1.0 (OMNR, 1996)

A. Habitat types influenced

Mature or old growth productive forests (mixed, deciduous and to lesser extent coniferous)
Snags
Downed woody debris

B. Intent of Guidelines

These guidelines were prepared as a commitment to the Class Environmental Assessment for Timber Management. The Pileated Woodpecker is representative of mature and old growth forest habitat in the Great Lakes-St. Lawrence Forest Region. Guidelines include provisions for the management of forest habitat in order to meet current and future habitat needs of the Pileated Woodpeckers throughout the Great Lakes – St. Lawrence forest region by:

1) allowing sufficient flexibility in management options to suit a variety of situations

C. Environmental and Biological Factors Affecting Management Options

- ✓ availability of large tracts of interconnected mature forest in the landscape
- ✓ current abundance and distribution of Pileated Woodpeckers

D. Management Approaches

- ☐ maintain sufficient supply of roosting trees, cavity nesting trees, potential cavity trees and trees that provide a food source
- ☐ encourage continuous, adequate supply of downed wood and dead standing trees

E. Level of Guideline Specialization

Provides an overview of habitat needs for the Pileated Woodpecker. Application of these guidelines should provide adequate habitat for other woodpecker and cavity nesting bird species.

F. Other Comments

- describes rationale and objectives for the guidelines
- deals with habitat needs at the *Stand Level* (10s' of hectares) and *Landscape Level* (1000s' of hectares)
- guidelines provide an extensive list of reference materials, ecosite types and criteria for selecting cavity trees

Habitat Management Guidelines for Cavity-nesting Birds in Ontario (OMNR, 1984)

A. Habitat types influenced

Semi-mature, mature forests (mixed, coniferous, deciduous)
Forest edge
Snags or hollow, living trees
Downed woody debris

B. Intent of Guidelines

Includes provisions for establishing minimum forest habitat for 27 cavity-nesting bird species and general habitat management guidelines by:

2) promoting the protection of large, undisturbed tracts of land
3) recommending minimum (not optimum) habitat requirements

C. Environmental and Biological Factors Affecting Management Options

- ✓ available number of snags in a given area
- ✓ variety of diameters and height of snags
- ✓ diversity of tree species and ages
- ✓ forest size
- ✓ width of riparian forest areas
- ✓ Site Region location
- ✓ presence/absence of primary cavity excavators

D. Management Approaches

- ☐ maintain large, undisturbed tracts of forest area (650-2500 ha)
- ☐ preservation of deciduous forests, particularly on the Canadian Shield (avoid clear cutting)
- ☐ maintain 100 m wide corridors between fragmented forest areas, especially along shorelines
- ☐ preservation of adequate number of trees with heart-rot, dead or dying trees, malformed trees
- ☐ girdle undesirable trees
- ☐ retain fallen logs and slash during forest operations
- ☐ create irregular forest edge habitat
- ☐ protection of riparian forests
- ☐ erect artificial nesting cavities (nest boxes)

E. Level of Guideline Specialization

Protection and preservation of optimum habitat requirements for primary cavity excavators, like the Pileated woodpecker, are most likely to provide sufficient habitat for other cavity-nesting bird species. Also see *Forest Management Guidelines for the Provision of Pileated Woodpecker Habitat (OMNR, 1996)*. In addition to birds, a variety of mammal, reptile and amphibian species benefit from the application of these guidelines. These species are generally ones that: a) require travel corridors to move from one habitat to another; b) require large tracts of mixed wood, deciduous and coniferous forests; and, use a variety of lowland and upland forests habitats; forest and riparian edge habitat; and, downed woody debris.

F. Other Comments

- provisions should be made to conserve tracts of forest large enough to provide for an entire bird population, not just a single, breeding pair

Habitat Management Guidelines for Warblers of Ontario's Northern Coniferous Forests, Mixed Forests of Southern Hardwood Forests (OMNR, 1984)

A. Habitat types influenced

Forests
Forest edge
Downed woody debris
Riparian areas

B. Intent of Guidelines

Provides forest management options to preserve and protect forest habitats in general and large forest habitats from fragmentation in particular.

C. Environmental and Biological Factors Affecting Management Options

- ✓ insect abundance
- ✓ availability of downed woody debris
- ✓ diversity of habitat (forest, forest edge, openings)
- ✓ forest size
- ✓ forest type (coniferous, deciduous, coniferous)
- ✓ stratification (overstory, understory, ground cover) within a stand (otherwise referred to as structure)
- ✓ location and availability of riparian areas
- ✓ presence of bird species (may include species requiring special habitat needs e.g. area sensitive, old growth forest)
- ✓ present and future development pressures

D. Management Approaches

- ☐ manage for larger rather than smaller tracts of forest
- ☐ maintain corridor connections between smaller forest areas
- ☐ avoid cutting riparian forests

E. Level of Guideline Specialization

Guidelines are somewhat generalized. Descriptions of specific species requirements is valuable.

F. Other Comments

- provides habitat requirements for 19 warbler species
- identifies species that require large tracts of forest (area sensitive species) and mature to old growth forests
- identifies species that are tolerant of timber harvest and may respond positively to logging
- identifies species that require dense growth of deciduous shrubs, riparian habitats, closed canopies
- includes a list of reference material

Bird Habitat Guidelines for Forests and Grasslands (Illinois Dept. of Conservation, c. 1988)

A. Habitat types influenced

Forests
Grasslands

B. Intent of Guidelines

To provide guidance to resource managers who wish to enhance habitat of grassland and forest interior birds.

C. Environmental and Biological Factors Affecting Management Options

- ✓ availability of larger-sized forest blocks situated away from forest edge effects
- ✓ availability of contiguous areas of grassy habitats (pasture, hayfields, but not row crops)
- ✓ presence/absence of highways or other disturbances
- ✓

D. Management Approaches

Forests

- ☐ avoid unnecessary fragmentation of forest
- ☐ maintain maximum contiguous woodland with least amount of edge in small tracts of forest (even as small as 2 ha
- ☐ retain connecting corridors between isolated forest tracts
- ☐ promote canopy closure
- ☐ retain diversity of vegetation
- ☐ plan to maximize unfragmented areas or reforest harvested or fragmented forest blocks
- ☐ restrict human activities during breeding season

Grasslands

- ☐ optimal area for restoration of grassland areas is more than 100 ha
- ☐ reduce amount of linear edge habitat
- ☐ adjacent areas should be open , not close to forest edge
- ☐ prescribed maintenance burning during early spring or late fall

E. Level of Guideline Specialization

For a variety of interior forest and grassland bird species.

F. Other Comments

- includes a list of references specific to forest interior bird species and grassland nesting birds
- includes a list of true grassland nesting bird species and other birds that may breed or spend part of their life in grasslands
- includes a list of area sensitive forest birds and minimum forest area required to sustain viable breeding populations
- a 1993 revision to this document entitled *Habitat establishment, enhancement and management for forest and grassland birds in Illinois* can be located on the following Internet web page: http://www.npwrc.usgs.gov/resource/othrdata/manbook/manbook.htm or, by writing to James R. Herkert, Division of Natural Heritage, Illinois Department of Conservation, Springfield, Illinois

Guidelines for the Protection of Forest-nesting and Wetland-nesting Bird Habitat by means of Modified Management Areas [draft] (OMNR, 1985)

A. Habitat types influenced

Mature or old growth forests
Forest edge
Riparian areas
Wetland areas

B. Intent of Guidelines

To help resource managers integrate wildlife management concerns into forest management plans and operations.

C. Environmental and Biological Factors Affecting Management Options

- ✓ presence of species with more specialized habitat requirements
- ✓ quality and quantity of available habitat (diversity, size)
- ✓ existing and future development pressures

D. Management Approaches

- ☐ aim to meet optimum, not minimum habitat requirements of wildlife species
- ☐ preserve snags, downed woody debris, riparian habitats
- ☐ manage for habitat diversity (species richness)
- ☐ provide forest tracts large enough to maintain healthy populations, not just single pairs

E. Level of Guideline Specialization

Special management guidelines are offered for Pileated Woodpecker (see 1996 guidelines), accipiters and buteos (see 1984 guidelines), Bald Eagle, Golden Eagle, Osprey, heronries (see 1987 and 1984 guidelines), Sand Hill Crane, Great Gray Owl, American Woodcock. Also provides general guidelines for wetland and forest habitats.

F. Other Comments

- includes a list of reference material
- includes species lists and habitat association, a list of area sensitive bird species, dimensions for building nest boxes for cavity-nesting birds
- recommends sizes of buffer zones around nest sites, by bird species

Habitat Management Guidelines for Waterfowl in Ontario (OMNR, 1985)

A. Habitat types influenced

Mature upland forests
Grasslands (openings)
Mature riparian forests
Wetland areas (critical habitat)
Open water areas

B. Intent of Guidelines

To assist resource managers in protecting and enhancing waterfowl habitat, particularly as it relates to timber harvesting.

C. Environmental and Biological Factors Affecting Management Options

- ✓ nesting and feeding requirements of ducks and geese
- ✓ forest/woodpecker associations (in provision of critical habitat for cavity nesting ducks)
- ✓ availability of wetland, riparian and upland forest habitats and their proximity to one another

D. Management Approaches

- ☐ restrict activities during waterfowl nesting period
- ☐ encourage preservation of riparian areas
- ☐ maintain uneven-aged, old growth forests with openings

E. Level of Guideline Specialization

Recommended management options are limited to forest management. Does not include recommendations for the management of habitat for all species of waterfowl.

F. Other Comments

- includes a list of waterfowl species that nest in forested areas of Ontario
- includes a list of reference material

Guidelines for Furbearer Habitat Management in Ontario (OMNR, 1985)

A. Habitat types influenced

Forests
Forest edge
Riparian areas
Wetland areas
Downed woody debris

B. Intent of Guidelines

To assist government and industry foresters and biologists to develop appropriate forest management prescriptions.

C. Environmental and Biological Factors Affecting Management Options

- ✓ whether furbearer is associated with forest or wetland habitats
- ✓ diet, size, reproductive requirements and behaviour of furbearers
- ✓ furbearer species interactions
- ✓ habitat diversity and availability
- ✓ water level permanence, fluctuation

D. Management Approaches

Wetland-associated furbearers

- ☐ protect wetland habitat from development (drainage, channelization, filling etc.)
- ☐ avoid development in riparian areas, particularly road development
- ☐ maintain wetland cover
- ☐ reduce water velocity and avoid extremes in water fluctuation that may negatively affect furbearers at critical periods in their life (e.g. extreme water fluctuations during winter months can either drown-out or freeze-out muskrats)

Forest-associated furbearers

- ☐ maintain dense, continuous overhead cover
- ☐ retain snags, downed wood
- ☐ protect old-growth forests
- ☐ manage for future mature – old growth forest
- ☐ protect large tracts of forested area
- ☐ retain or create corridors to connect smaller tracts of forest

E. Level of Guideline Specialization

Maintaining habitat quality of beaver and muskrat will have beneficial effects on habitat of mink, otter and other wetland species. Forest-associated furbearers have a wide diversity of habitat requirements, larger carnivores requiring larger, contiguous tracts of forested area. Management for these species benefit their prey (e.g. small mammals such as rabbits, voles, mice).

F. Other Comments

- specific measures may be needed to meet the needs of individual species
- guidelines include a list of reference material and description of individual species requirements

Habitat Management Guidelines for Birds of Ontario Wetlands, including marshes, swamps and fens or bogs of various types (OMNR, 1985)

A. Habitat types influenced

Wetlands – a variety of different types of marsh, swamp, bog or fen habitat
Riparian areas
Open water areas
Forest edge
Seepage areas

B. Intent of Guidelines

Includes provisions for timber harvest operations that are intended to help preserve remaining wetland habitat in Ontario for 66 Ontario wetland bird species by -

1. promoting the protection of riparian forests and forests on steep banks
2. recommending a minimum no-cut zone (50 m) on either side of a river or lake
3. providing suitable conditions for all wetland species by managing optimum habitat for the more habitat-specific species

C. Environmental and Biological Factors Affecting Management Options

✓ existing size, form and function of wetland
✓ wetland rarity (e.g. marshes are more rare in northern Ontario, whereas bogs are more rare in southern Ontario)
✓ species diversity (flora and fauna)
✓ surrounding land uses
✓ future development pressures

D. Management Approaches

☐ preserve all remaining wetlands, particularly rarer forms that support several rare species of flora or fauna
☐ conserve riparian and drier surrounding edges
☐ avoid creating channels in river wetlands
☐ discourage logging or development of swampy and riparian areas
☐ encourage natural water regulation to promote a diversity of plant life
☐ avoid use of chemical pesticides
☐ encourage public education programs and stewardship
☐ encourage research on wetland species
☐ identify critical breeding, migration areas for rare species, or areas of high use
☐ consider limiting recreational use of critical wetland areas during the breeding season
☐ encourage wetland creation

E. Level of Guideline Specialization

Habitat requirements for a large number of species of flora and fauna are met when wetland habitat in general is protected.

F. *Other Comments*

- an important aspect of wetland protection and management is the preservation of the area where water and land meet (riparian zone)
- protection of provincially significant wetlands now also involves the recognition of a 120 m adjacent land area since many species use both wetland and upland areas to meet all their life's requirements

- for many species that are not area sensitive this adjacent land area may be sufficient to provide the required travel corridors to move from one habitat to another, or meet a breeding, nesting, foraging or shelter habitat requirement
- upland habitat may include: mixed-wood, deciduous, coniferous forests; open grassland areas; forest edge; and, downed woody debris

Management Guidelines for the Protection of Heronries in Ontario (OMNR, 1984)

A. Habitat types influenced

Mature hardwood forest types
Forest edge
Riparian areas
Wetland areas (marshes for feeding; swamps for nesting)

B. Intent of Guidelines

Includes provisions for preventing the loss of heron and egret colonial nesting sites by:

1) encouraging educational programs to promote appreciation of herons
2) providing information about the sensitivity of herons to disturbance
3) specifying buffer zones for different levels of development disturbance

C. Environmental and Biological Factors Affecting Management Options

- ✓ size of colony
- ✓ location of colony
- ✓ level of significance a colony has to the contribution of regional heron populations
- ✓ quality of habitat conditions throughout the landscape

D. Management Approaches

- ☐ conduct inventory of existing heronries and potential nest sites
- ☐ protect and manage relative to size of heronry, and its significance to regional population of herons
- ☐ conserve habitat for future heronries
- ☐ develop and follow buffer zone criteria for various levels of development
- ☐ specify activities prohibited and permitted during the breeding and non-breeding season

E. Level of Guideline Specialization

Specific to Great Blue Heron, Black-crowned Night Heron, Green Heron, Great Egret, Cattle Egret, although management techniques and use of buffer zones during development activities may benefit other wetland species, including Osprey.

F. Other Comments

- includes field and record sheets for the Ontario Heronry Inventory
- includes a dated but extensive list of reference material

Management Guidelines and Recommendations for Osprey in Ontario (OMNR, 1983)

A. Habitat types influenced

Open water areas
Riparian areas (treed)
Wetland areas (treed)

B. Intent of Guidelines

Includes provisions for Osprey habitat and nest site improvement and preservation.

C. Environmental and Biological Factors Affecting Management Options

- ✓ distribution and abundance of Osprey
- ✓ Osprey health (in the past, reproductive success has been negatively affected by high levels of pesticides)
- ✓ level of human disturbance

D. Management Approaches

- ☐ maintain and report nesting records of Osprey (assists in estimating breeding bird populations)
- ☐ develop and follow buffer zone criteria for various levels of development according to northern and southern Ontario criteria
- ☐ specify activities prohibited and permitted during the breeding and non-breeding season
- ☐ encourage educational programs to promote awareness and appreciation of Osprey

E. Level of Guideline Specialization

Specific to Osprey. Osprey may also benefit from the protection of heronries.

F. Other Comments

- includes a standard inventory data sheet for nesting osprey
- includes a dated list of references

Habitat Management Guidelines for Ontario's Forest Nesting Accipiters, Buteos and Eagles (OMNR, 1984)

A. Habitat types influenced

Mature or old growth forests (mixed, deciduous and to lesser extent coniferous)
Forest edge
Riparian areas
Wetland areas

B. Intent of Guidelines

Includes provisions for the protection of nesting and feeding habitats of six forest nesting species of raptors by:

1) promoting the preservation of riparian forest habitat, forest edges and openings
2) managing for present and future trees suitable for nesting and perching
3) recognizing many raptors are area sensitive
4) limiting human disturbances

C. Environmental and Biological Factors Affecting Management Options

- ✓ Site Region location of forest stand
- ✓ existing size of forest
- ✓ raptor species involved and its specific habitat requirements

D. Management Approaches

- ☐ maintain extensive forest cover, particularly near riparian edges
- ☐ suppress human activities where raptors are known to occur, particularly during the nesting season
- ☐ manage areas to provide adequate nesting and perching sites

E. Level of Guideline Specialization

Specific habitat requirements and forest management guidelines are outlined for the following diurnal forest-dwelling raptors: Northern Goshawk, Cooper's Hawk, Sharp-shinned Hawk, Red-shouldered Hawk, Broad-winged Hawk and Bald Eagle.

F. Other Comments

- of all the bird species, raptors are among the most easily disturbed by clearing or logging practices
- provision of only minimum habitat requirements may lead to sub-optimal conditions that can lead to low nesting success and eventual extinction of a population
- guidelines include a copy of the inventory data sheet and the Ontario nest record card
- guidelines include a dated but extensive list of reference material

F5

Peregrine Falcon Habitat Management Guidelines (OMNR, 1987)

A. Habitat types influenced

Cliffs
Urban settings (sometimes nesting on tall buildings)
Open areas
Wetland areas
Forest (early successional and mature)

B. Intent of Guidelines

To provide criteria for the protection of existing and potential Peregrine Falcon nesting sites and for the protection of Peregrine Falcons from human disturbance during the breeding season.

C. Environmental and Biological Factors Affecting Management Options

- ✓ Peregrine Falcon occurrence and distribution
- ✓ variability in tolerance to human presence
- ✓ availability of nesting sites adjacent to open water of lakes or rivers
- ✓ proximity of potential hunting areas (lakes, wetlands, forest openings, forest canopy) to the nest site
- ✓ availability of prey
- ✓ location and rate of human development as they relate to nesting site

D. Management Approaches

- ☐ survey for presence of Peregrine Falcon, assess habitat potential (data records)
- ☐ collect information on historical nesting records for an area
- ☐ identify and preserve Peregrine Falcon hunting areas
- ☐ prepare site-specific management plans (within 3 km radius) for each nest site
- ☐ identify buffer zones around nests within which human activities and habitat alterations are restricted
- ☐ buffer zones above cliffs where nesting sites (eyries) are located should be wider than those at base of cliff
- ☐ prohibit human recreational activities with 0.6 and 0.8 km of nest site during breeding season
- ☐ preserve potential nest sites

E. Level of Guideline Specialization

Specific to Peregrine Falcons, but preservation of habitat types that provide nesting sites for prey species for Peregrines also preserve habitat for other species.

F. Other Comments

- cliffs and urban areas provide nesting sites for Peregrines; open areas, wetlands, forests provide sites that produce prey species suitable for Peregrines (e.g. protection of snags preserves habitat for cavity nesting bird and mammal species)
- guidelines include a one page summary of a Peregrine Falcon nest site management plan
- guidelines include a short list of reference material

Bald Eagle Habitat Management Guidelines (OMNR, 1987)

A. Habitat types influenced

Mature or old growth forests (super canopy trees)
Forest edge
Riparian areas
Open water

B. Intent of Guidelines

To provide criteria for the protection and maintenance of Bald Eagle breeding habitat and for the protection of Bald Eagles from human disturbance during the breeding season.

C. Environmental and Biological Factors Affecting Management Options

- ✓ Bald Eagle occurrence and distribution
- ✓ variability in eagle tolerance to human presence
- ✓ availability of large contiguous areas of habitat
- ✓ rate of human development

D. Management Approaches

- ☐ survey for presence of Bald Eagle, assess habitat potential (data records)
- ☐ essential habitat at each nest site includes aquatic and terrestrial habitats of 260 hectares (640 acres) or more
- ☐ prepare site-specific management plans to suit size and configuration of essential habitats
- ☐ identification of buffer zones around nests within which human activities and habitat alterations are restricted
- ☐ maintain prey base consistent with Bald Eagle food habits (fish)
- ☐ preserve potential nest and roost trees

E. Level of Guideline Specialization

Specific to Bald Eagle and Golden Eagle with one exception (see *Golden Eagle Habitat Management Guidelines* for exception)

F. Other Comments

- includes list of reference material
- includes Bald Eagle Breeding and Nest Area Record sheets

Golden Eagle Habitat Management Guidelines (OMNR, 1987)

A. Habitat types influenced

Mature or old growth forests
Forest edge
Grasslands
Wetland areas
Rock cliffs

B. Intent of Guidelines

To provide criteria for the protection and maintenance of Golden Eagle breeding and foraging habitat and for the protection of Golden Eagles from human disturbance during the breeding season.

C. Environmental and Biological Factors Affecting Management Options

- ✓ Golden Eagle occurrence and distribution
- ✓ variability in eagle tolerance to human presence
- ✓ availability of large contiguous areas of forest habitat with large, adjacent clearings
- ✓ rate of human development

D. Management Approaches

- ☐ survey for presence of Golden Eagle, assess habitat potential (data records)
- ☐ essential habitat at each nest site includes aquatic and terrestrial habitats of 260 hectares (640 acres) or more
- ☐ prepare site-specific management plans to suit size and configuration of essential habitats
- ☐ identification of buffer zones around nests within which human activities and habitat alterations are restricted
- ☐ maintain prey base consistent with Golden Eagle food habits (small mammals, particularly rabbits or hares)
- ☐ preserve potential nest and roost trees

E. Level of Guideline Specialization

For full description of guidelines see *Bald Eagle Habitat Management Guidelines (1987)*, with the exception that Golden Eagles benefit from large, contiguous clearings beyond 100 m from the nest site. These clearings are used as feeding areas.

F. Other Comments

- Golden Eagles are highly sensitive to disturbance during the breeding season

Forest Management Guidelines for the Provision of Marten Habitat Version 1.0 (OMNR, 1996)

A. Habitat types influenced

Moist, mature or overmature coniferous forests
Hardwood dominated forests and wetlands to a lesser extent

B. Intent of Guidelines

These guidelines were prepared as a commitment to the Class Environmental Assessment for Timber Management. The Marten is representative of contiguous, mature forest habitat in the Boreal Forest Region. Includes provisions for the management of forest habitat in order to maintain sufficient quality and quantity of habitat to support healthy populations of marten in the boreal forest region.

C. Environmental and Biological Factors Affecting Management Options

- ✓ availability of suitable forest coverage (hectares) and type and interconnecting corridors
- ✓ availability of downed wood on the forest floor
- ✓ prey availability
- ✓ current abundance and distribution of marten

D. Management Approaches

- ☐ maintain core habitat areas of between 30 and 50 km^2
- ☐ maintain diversity of surrounding habitats to increase diversity of potential prey
- ☐ provide suitable numbers and distribution of potential maternal and resting den sites

E. Level of Guideline Specialization

Provides an overview of habitat needs for marten. Application of these guidelines may provide some habitat required by other mammals and birds that are associated with mature and overmature forests, cavity trees and coarse woody debris.

F. Other Comments

- describes rationale and objectives for the guidelines
- deals with habitat needs at the *Stand Level* (10s' of hectares) and *Landscape Level* (1000s' of hectares)
- guidelines provide an extensive list of reference materials

Habitat Management Guidelines for Bats of Ontario (OMNR, 1984)

A. Habitat types influenced

Forests (particularly snags that provide roosting sites)
Riparian areas (critical)
Aquatic areas (critical)
Natural and man-made caves
Urban and rural areas (open buildings)

B. Intent of Guidelines

Summarizes general and specific habitat requirements for a number of bat species.

C. Environmental and Biological Factors Affecting Management Options

- ✓ bat habits, diet
- ✓ specialized habitat requirements for some species of bats
- ✓ temperature
- ✓ humidity
- ✓ availability and location of natural or man-man caves

D. Management Approaches

- ☐ protect all known major and marginal hibernacula
- ☐ protect roost sites (e.g. snags)
- ☐ restrict activities during periods of roosting and hibernation (caves, hollow trees)
- ☐ limit accessibility to known hibernation sites
- ☐ avoid disturbance of riparian areas
- ☐ provide artificial roost sites (bat houses)

E. Level of Guideline Specialization

While specifically written for bats, recommendations provided in these guidelines offer protection of habitat components (e.g. snags and cavities) for other wildlife species. Potential roosting sites for bats may also be protected through the application of habitat management guidelines for other cavity nesting species.

F. Other Comments

- bats are unique and specialized in their habits and habitat requirements
- roosting and hibernation site availability is main factor limiting bat populations
- guidelines include distribution maps, a description of habits, diet and habitat requirements for eight bat species, a list of reference material, a summary of bat diseases, instructions on how to build a bat house

Forest Management Guidelines for the Provision of White-tailed Deer Habitat (OMNR, 1997)

A. Habitat types influenced

Coniferous forests
Early successional forests
Forest edge
Grasslands

B. Intent of Guidelines

Includes provisions for summer and winter deer habitat by -

1) promoting early successional growth for summer forage production
2) protecting known migration and travel routes
3) maintaining conifer cover and providing sufficient deer browse

C. Environmental and Biological Factors Affecting Management Options

- ✓ quality, quantity and availability of cover- and forage-species
- ✓ quality of summer habitat
- ✓ quantity and quality of winter habitat
- ✓ winter severity
- ✓ traditional deer-use patterns

D. Management Approaches

Winter Habitat

- ☐ select for conifer species
- ☐ promote regeneration of hemlock and cedar specifically
- ☐ retain browse species such as cedar, hemlock, viburnums, maples, red oak, dogwood, beaked hazel, birch

Summer Habitat

- ☐ establish openings (0.4 to 4 ha in size)
- ☐ promote growth of grasses, annuals, forbs
- ☐ retain or release growth of mast producing species (oak, beech, raspberry)

E. Level of Guideline Specialization

Protection of deer habitat also provides habitat for a variety of species that: a) rely on mast producing trees and plants; b) require travel corridors to move from one habitat to another; and, c) use upland forest; lowland treed swamp areas; open grassland areas; forest edge; and, downed woody debris.

F. Other Comments

- areas of irregular terrain and areas containing wind-throws or downed woody debris provide good winter habitat
- hemlock and cedar are best conifer cover, often associated with preferred browse species
- browse should be within 30 m of suitable winter cover in northern areas; 100 m in southern areas
- protection of known travel corridors is essential
- quality of summer habitat determines reproductive rate
- quality of winter habitat and winter severity determines spring survival

Forest Management Guidelines for the Provision of Moose Habitat (OMNR, 1988)

A. Habitat types influenced

Coniferous forests
Early successional forests
Forest edge
Wetlands

B. Intent of Guidelines

Includes provisions for protecting moose habitat in the Boreal and Great Lakes-St. Lawrence Forest Regions by -

1) promoting growth and abundance of young deciduous stands
2) protecting known feeding areas, calving sites and mineral licks
3) maintaining large areas of semi-mature and mature conifer cover

C. Environmental and Biological Factors Affecting Management Options

✓ quality, quantity and availability of specific (high sodium content) aquatic plant species
✓ quality and quantity of summer, fall and early winter habitat (early successional forests)
✓ availability and quality of winter concentration areas, mineral licks, calving areas
✓ traditional moose-use patterns
✓ occurrences of natural disturbances such as fire or insect damage
✓ forest region differences (e.g. winter severity; dominant forest types)

D. Management Approaches

☐ select harvest operations that create irregularly shaped cuts, scattered shelter patches, high diversity of age-class and species composition
☐ prescribed burns
☐ in the Boreal Forest Region, maintain growth of existing and encourage growth of new mixed wood stands; in the Great Lakes St. Lawrence Forest Region maintain existing semi-mature and mature coniferous growth
☐ exclude development (particularly roads) near or in known mineral lick and calving sites and aquatic feeding areas
☐ establish forested buffer zones between clear cuts, scattered trees within cutovers; shelter patches 3-5 ha in size, spaced 300-400 m apart, being at least 6 m high and have 11 m^2ha^{-1} basal area

E. Level of Guideline Specialization

It has been estimated that the needs of 70% of all wildlife in an area will be satisfied if provisions for moose habitat are made in accordance with these guidelines. Protection of moose habitat provides habitat for a variety of species that: a) require travel corridors to move from one habitat to another; inhabit treed islands; and, c) use mixed wood and coniferous forests; lowland treed swamp, bog or marshy areas; open grassland areas; forest edge; and, downed woody debris.

F. Other Comments

- the best habitat should provide conditions enabling a moose to be within 200 m of shelter patches or other cover
- a buffer of 120 m should be maintained around aquatic feeding areas, mineral licks and calving sites; travel corridors to these areas should be maintained

The Black Rat Snake in Ontario, Rideau Lakes Population (OMNR, 1977) - A Field Guide

A. Habitat types influenced

Talus slopes
Rock outcroppings
Downed woody debris
Forests
Forest openings, grasslands

B. Intent of Guidelines

Is not a guidelines document but represents a collection of information on black rat snakes, with a particular reference to an area in eastern Ontario.

C. Environmental and Biological Factors Affecting Management Options

- ✓ increases in vehicular traffic
- ✓ interactions with human activity
- ✓ availability of suitable habitat and sufficient prey
- ✓ presence of predators
- ✓ development pressures and loss of habitat

D. Management Approaches

- ☐ hold public education events regarding the conservation of black rat snakes
- ☐ conduct population assessments and estimates
- ☐ locate and evaluate habitat (identify hibernacula and nesting sites)
- ☐ protect known nesting and hibernation sites

E. Level of Guideline Specialization

Specific to the black rat snake. Not a true habitat management guidelines document.

F. Other Comments

- this document is available for viewing at Kemptville District Office or from the Science Technology Transfer Unit, Kemptville; it may not be readily available at other MNR offices
- provides a concise description on the range, habitat, prey, hibernation, reproduction of the black rat snake
- includes a list of reference material